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ABSTRACT

This curriculum guide for advanced food science and nutrition is one of a number of guides developed for use in vocational home economics education in Texas. Introductory materials address use of the guide and list the essential elements upon which the content is based. The guide is divided into five units: the significance of nutrition, food processing and marketing, food science and food products, food and nutrition technology, and career options and adjustments. Each unit lists competencies and subcompetencies at the beginning of the section. Concepts related to the competencies are listed in the right-hand columns. Learning and evaluation experiences are found in the left-hand columns. Teaching aids keyed to learning and evaluation experiences--including transparency masters, activities, and exercises--are located at the end of the guide. Designations have been used in the content for (1) developing skills within the Texas Common Elements for all vocational education; (2) applying basic/academic skills; and (3) developing critical thinking skills. Key points for content discussion and review and methods for developing critical thinking skills are also indicated. (YLB)

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ADVANCED FOOD SCIENCE AND NUTRITION

VOCATIONAL HOME ECONOMICS EDUCATION

TEXAS EDUCATION AGENCY

AUSTIN, TEXAS

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ADVANCED FOOD SCIENCE AND NUTRITION

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COMPLIANCE STATEMENT

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(4) nondiscriminatory practices in the hiring, assigning, promoting, paying, demoting, reassigning, or dismissing of faculty and staff members who work with children;

(5) enrollment and assignment of students without discrimination on the basis of race, color, or national origin;

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ADVANCED FOOD SCIENCE AND NUTRITION

Advanced Food Science and Nutrition is one of the various curriculum guides developed for use in Vocational Home Economics Education in Texas. Additional guides are available for secondary education in the areas of Comprehensive and Technical Home Economics, Home Economics Cooperative Education, Home Economics Pre-employment Education (including courses designed for the academically disadvantaged and handicapped students). Other guides are available for adult education and post-secondary education in home economics subject training areas.

Overview of the Guide

Each subject guide is written to the teacher and is correlated closely with the Essential Elements prescribed by the State Board of Education in Texas Administrative Code 75.50 (b), and 75.83 (a) thru (x). The competencies in each guide are the essential elements and the sub-competencies are the sub-elements prescribed in the Texas Administrative Codes for Vocational Home Economics. The conceptual outline as shown in the left hand column (a corresponding learning and evaluation experiences in the right hand column) relate to the sub-element of each unit. Teaching Aids keyed to the learning and evaluation experiences are located at the end of each book. Designations have been used in the content for developing skills within the Common Elements to all vocational education courses with a designation of [C]. The application of basic/academic skills has been given a designation of [B]. Key points for content discussion and review have been given a KEY QUESTION designation, and methods for developing critical thinking skills have been given a CRITICAL QUESTION designation.

Particular care has been taken to provide age appropriate concepts and learning activities. Teachers will need to exercise judgement, initiative, imagination, and creativity in working cooperatively with students, parents, school administrators, and local advisory council members to develop a local program that will serve the students enrolled in Vocational Home Economics Education. The subject area guides are intended to guide the content, not dictate the content.

TEACHERS SHOULD NOT EXPECT TO USE ALL OF THE SUGGESTED EXPERIENCES IN ONE CLASS NOR FEEL THAT ALL ARE NEEDED TO TEACH ONE ESSENTIAL ELEMENT (WHICH INCLUDES THE COMPETENCY AND SUB-COMPETENCIES). The variety of experiences included should enable teachers to select and use those teaching-learning experiences that will help students reach the objectives.

An excellent resource for information on teaching all students is the book, *Guide to Teaching*. The book addresses methods for teaching students with varying learning levels. It also provides special guidelines and information regarding the at-risk students and the disabled or handicapped students.

TAC 75.83
ADVANCED FOOD SCIENCE AND NUTRITION

(j) Advanced food science and nutrition (1/2 unit) shall be a laboratory-oriented course and include the following essential elements:

(1) Concepts and skills related to the significance of nutrition. The student shall be provided opportunities to:

(A) analyze the influence of economics on obtaining adequate nutrition;
(B) relate the role of nutrition to the prevention and treatment of health problems;
(C) plan diets to meet special dietary needs;
(D) summarize methods for retaining nutrients in foods;
(E) assess the safety factors of various intentional and incidental food additives;
(F) determine factors affecting the world food supply;
(G) describe international organizations contributing to improved nutrition; and
(H) relate nutrition to international trade, governmental relations, and world progress.

(2) Concepts and skills related to food processing and marketing. The student shall be provided opportunities to:

(A) summarize the scientific and creative aspects of food processing and marketing;
(B) outline safety and sanitation considerations for food processing and packaging;
(C) assess methods for processing foods;
(D) analyze the impact of processing on product quality, nutrition, and taste; and
(E) discuss chemical reactions that occur during food processing.

(3) Concepts and skills related to food science and food products. The student shall be provided opportunities to:

(A) evaluate the quality of food products for compliance with established standards;
(B) determine the effect of various forms of ingredients on food products;
(C) determine the effect of various manipulative procedures on the quality of selected food products;
(D) determine the effect of various cooking utensils on food products;
(E) determine the effect of various temperatures on food products;
(F) evaluate the effect of various leavening agents on food products;
(G) analyze principles of protein, vitamin, and carbohydrate cookery;
(H) analyze factors which affect fat absorption when frying foods; and
(I) determine methods for making food products more nutritious.

(4) Concepts and skills related to foods and nutrition technology. The student shall be provided opportunities to:

(A) evaluate new forms and sources of foods and food products;
(B) summarize major research in nutrition and food science;
(C) discuss the effect of technology on food and nutrition and food supply, marketing, and distribution; and
(D) propose ways to disseminate and use reliable nutrition information.

TAC 75.83
ADVANCED FOOD SCIENCE AND NUTRITION
UNIT I

COMPETENCY: (j.1) *Concepts and skills related to the significance of nutrition.*

SUB-COMPETENCIES:

(A) *Analyze the influence of economics on obtaining adequate nutrition.*

(B) *Relate the role of nutrition to the prevention and treatment of health problems.*

(C) *Plan diets to meet special dietary needs.*

(D) *Summarize methods for retaining nutrients in foods.*

(E) *Assess the safety factors of various intentional and incidental food additives.*

(F) *Determine factors affecting the world food supply.*

(G) *Describe international organizations contributing to improved nutrition.*

(H) *Relate nutrition to international trade, governmental relations, and world progress.*

CONCEPTS

I. Significance of nutrition
  A. Economic influence
    1. Food supply and demand

LEARNING AND EVALUATION EXPERIENCES

Have students choose a food and determine the origin of the food. The origin of a food can be identified in terms of a location, such as a particular country, a region or state in a country, or a part of the world which has a climate which is conducive for the farming, fishing, or manufacturing of the food. Resources might include encyclopedias, almanacs, or atlases with information on major farm products of states, local merchants, and wholesalers. Consolidate the information on a class map which indicates food origins.

Have students view audiovisuals on the concepts of the food chain. Plant and animal aspects of the total food chain should be included in the audiovisual presentations. Lead a class discussion on the importance of the food chain in the United States and in the world. Address how the food chains may vary in different parts of the United States and in various parts of the world. KEY QUESTIONS: If parts of the food chain are interrupted in the world, how might this impact on world food production, food availability, nutrition, and well-being of the population? What can individuals or governments do to help assure the continuance of the food chain? How fragile is the food chain? How can human beings help or hinder the food chain?

Using Teaching Aid 1, Food Chain, lead a class discussion regarding the concept of food chains. Show how costs increase as foods are selected which are higher on the food chain. Explain what contributes to these costs, such as fuel costs, human labor in production and processing, and the expense of technology required in handling and refining foods. Review Teaching Aid 2, Food Consumption Patterns.

Lead a class discussion on how underdeveloped, developing, and developed countries differ in the foods which provide the mainstays of their diets. For example, unrefined grain products, such as rice, are consumed as major parts of the diet in underdeveloped countries; home and farm grown vegetables such as potatoes, provide a large portion of the calories in the diets of persons in developing countries; and highly processed foods and meats are the dietary mainstays in developed countries. Have students to identify underdeveloped, developing, and developed countries. Lead a class discussion regarding the major diets of people in the underdeveloped, developing, and developed countes. KEY QUESTIONS: What nutrients are unavailable? Even though nutrients may be available, are they being consumed? CRITICAL QUESTION: What could be done or practiced in undeveloped, developing, and developed countries which would promote good nutrition?

Have students select a food, such as spinach, whole wheat bread, or grapefruit, and determine the steps that the food progresses through from the point of growing in the field until it is served at a meal. Critical steps may include the following depending upon the specific food selected: planting seed/plant; fertilizing; watering; pruning; thinning; spraying (pests, virus, fungi, or weeds); harvesting; transportation to market, storage; farm marketing; food processing; transportation; wholesale distribution; retail distribution; and commercial/home food preparation. Lead a class discussion regarding the complexity of the food industry, including the number of steps required so that the foods the American public demands are maintained in adequate supplies and quality. Have students hypothesize about the effects of the increasing complexity of the food system, identifying implications in terms of costs, energy usage, dependence on available labor, competing needs of Third World countries seeking basic foods rather than highly processed food products, and the demand of the American public for foods which are higher on the food chain. KEY QUESTIONS: Why is the food system in this country more complex today than it was at the beginning of the 20th Century? Are American consumers justified in their demand for highly processed and expensive foods? Why or why not? Why are American consumers able to have the best food supply in the world? How has the American farmer and agriculture been able to make it possible for Americans to have abundant food supplies and to be the best fed country in the world?

Have students study references on factors which affect food prices. Include farm expenses, crop size, weather conditions, processing, transportation, marketing, advertising, storage, government regulations, and/or shoplifting. Lead a class discussion on these factors. Refer to Teaching Aid 3, Organically and Inorganically Grown, to begin the discussion on factors influencing food supply and prices.

Divide the class into groups and assume that they are members of the President's Economic Advisory Committee. Each group's job is to predict how and why the price of apples would be affected in a given situation. Report the predictions to the class. Situations might include: demand rises (price rises); demand falls (price falls); supply rises (price falls); production cost rises (price rises); production cost falls (price falls); increased concentration of ownership (price rises); and decreased concentration of ownership (price falls).[C]

Use references or invite the agricultural teacher or extension agent to identify food products currently in shortage in the economy. KEY QUESTIONS: What is the relationship between the products' price, supply, and demand? How does foreign trade impact on products, supply, demand, and price?

As an enrichment experience, have students write to the United States Department of Agriculture (USDA) or the Food and Drug Administration (FDA) to obtain information about current legislation related to the domestic food supply. Share the information with the class.[B] [C]

Have students review references and become familiar with government agencies involved with the consumer aspects of food. Include the USDA, FDA, and the Federal Trade Commission (FTC). KEY QUESTION: What are the major responsibilities of these agencies regarding the nation's food supply?

As an enrichment experience, have students research the various government programs which influence the domestic food supply. Divide into debate teams and research the advantages and disadvantages which may result from implementation of each

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[C] = Common Essential Element

[B] = Basic Skill Reinforcement

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program. Have each debate group elect a team captain to be in charge of the group. Before beginning, draw up rules and review the procedures to be followed. Evaluate the debate on content and the student ability to communicate effectively through oral debate. Programs for debate may include: farm subsidies, price supports, government food inspection, government buying of surpluses or commodities, exports and imports, food embargos, school lunch, and other Federal feeding programs, commodity distribution programs, and food stamps.[B] [C]

2. Alternatives

Lead a class discussion by asking students to imagine how they might obtain adequate food if all of the grocery stores and other retailers of food, including restaurants and fast food chains, closed their doors. Ask students to suggest other sources of food which might be available in the community, such as home gardening, farmers' markets, roadside stands, and cooperative buying of food by a group from wholesalers. Take a field trip to a food buying club or cooperative or invite a local grower who raises vegetables and/or fruits to speak on production, production costs, marketing or preservation of products, government regulations, environmental concerns, and labor requirements. Following the field trip and/or resource speaker, lead a class discussion regarding how students' diets would change if grocery stores and other stores which sell food disappeared. Identify students in the class who eat foods which are grown at home and/or are purchased from local growers. Ask them to discuss the advantages and disadvantages of obtaining particular foods from sources other than the typical retail outlet.

Have students study resources for suggestions of ways to reduce the cost of food in one's diet. Assign students to explain food preparation techniques which could possibly cut costs, such as making yogurt, granola, baby foods, breads and bulk mixes at home rather than buying these products. Have students determine the cost of the items if purchased and the cost of the items if prepared at home. KEY QUESTIONS: What are the hidden costs if any? Are all home prepared foods, breads, bulk, or mixes less expensive than commercially prepared items? What are the disadvantages of preparing breads, baby foods, or bulk foods at home?[B]

Have students view audiovisuals or read resource material on maintaining and utilizing overripe or damaged fruits and/or vegetables, mature meats, fish, and poultry, and other foods in conditions that make them safe and suitable for human consumption. NOTE: Include information on freeze or weather

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[B] = Basic Skill Reinforcement
[C] = Common Essential Element

damaged foods and over mature foods. Food processing of damaged and over mature foods should be explored. For example, over mature tomatoes might be processed and canned as tomato soup or tomato pieces, freeze damaged oranges might be processed into orange juice, and mature cows and bulls might be processed into canned or potted meat products. KEY QUESTIONS: Why do food processors and manufacturers use some damaged and over mature foods? Why is it not economical or reasonable to destroy all damaged or over mature foods? If the foods were destroyed, how might this impact the availability of foods in the United States and food costs? What steps do food processors, manufacturers, and the government take to help assure the safety of the food supply? What are examples of other overripe or mature foods that are commonly processed into food products? What are some examples of ways in which families utilize overripe, stale, or mature foods in their own home kitchens rather than destroying it? (Some examples would be to use stale bread in casseroles, puddings, stuffings, or for toast, and to use overripe bananas in making milk shakes and quick breads.) Why is it important for food processors, food manufacturers, food distributors, food service establishments, and families to avoid food waste?

B. Nutrition and the prevention and treatment of health problems

Have students review resources to obtain information on nutrition and the common cold, nutrition and cancer, and nutrition and heart disease. Have students use the reference materials to prepare a report, which discusses and emphasizes a particular fact or claim. Have the students present the information to the class through oral reports.[B]

Invite a resource person to class to discuss nutrition and the common cold, nutrition and cancer, and nutrition and heart disease. Have students prepared to ask the resource person questions. KEY QUESTIONS: Is there a documented connection between nutrition and the common cold, cancer, and heart disease? What common practices can help individuals avoid the diseases or disorders? Is nutrition a contributing factor to all types of cancer and heart disease? Why or why not?

Invite a guest speaker, such as a dietitian or gerontologist, to class to discuss the effect of nutrition on the aging process. Have the students prepared to ask the resource person questions.

Have students interview elderly persons about their eating habits throughout the years. Have students assess the knowledge and interest in nutrition of the persons interviewed. Encourage students to ask the persons about their beliefs regarding what is

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[B] = Basic Skill Reinforcement

good to eat and how the food they eat meets their nutritional needs. Lead a class discussion regarding the concerns of the elderly related to their diet, how their food preferences affect the nutritional balance of their daily food intake, and what foods should be added to or increased in their diets to improve their nutritional health.

Have students read library references and other resource materials on cholesterol. Lead a class discussion to identify foods containing cholesterol and the potential problems associated with the consumption of certain types of cholesterol. KEY QUESTIONS: What foods contain medium to high levels of cholesterol? What foods contain low levels of cholesterol? What are some foods that do not contain cholesterol? What are some foods than contain hidden amounts of cholesterol? What factors contribute to high cholesterol consumption? What types of potential problems can result form high cholesterol consumption? How can problems from cholesterol consumption be reduced or prevented? What research is being done to lessen problems from cholesterol?[B]

C. Plan diets to meet special dietary needs
   1. Common special diets

Have students prepare a list of foods with hidden sugar and sodium. List the foods on the chalkboard or on a poster. Lead a class discussion regarding the hidden sources and how often they are consumed. Refer to Teaching Aid 4, Sodium Content of Selected Foods, and Teaching Aid 5, Sugar Content of Breakfast Cereals. Using Teaching Aid 6, Create a Low-Sugar Menu, and Teaching Aid 7, Create a Low-Sodium Menu, have students make menu substitutions to improve the sample menus. KEY QUESTIONS: How important is knowledge about hidden sugar and sodium in foods? How can consumers be aware of hidden nutrients? Can sodium and/or sugar be reduced in food products and still maintain food quality and taste? Why or why not? What are some strategies for reducing sodium in the diet? What are some strategies for reducing sugar in the diet?

Lead a class discussion regarding the definition of high fiber foods, their importance and function, and food sources. Then, divide the class into groups and have them plan a three day menu focusing on a high fiber diet. Have the groups determine the amount of fiber included in the menu. Then have the students make recommendations for alternate foods which could be substituted or added that would increase fiber in the menu. Refer to Teaching Aid 8, Put Fiber In Your Menu, as a menu example which needs adjustment. Analyze the diet using a dietary analysis computer program. Make corrections in the diet if needed.[C] [B]

[B] = Basic Skill Reinforcement

[C] = Common Essential Element

Lead a class discussion on cholesterol and low-fat diets. Identify food sources high in cholesterol. Discuss in class the relationship between cholesterol and 1) heart disease (arteriosclerosis), 2) saturated and unsaturated fats, 3) exercise, and 4) obesity. Lead a class discussion regarding the importance and need for low-fat diets. KEY QUESTIONS: What guidelines should be followed to achieve a diet which is low in fat? What are some examples of changes in food habits which would result in lower fat intake? NOTE: For example, seasoning a baked potato with lemon juice rather than sour cream; broiling chicken rather than frying chicken; and seasoning vegetables with herbs rather than seasoning with butter or margarine. Make available to the students a variety of food labels which note that fat has been added to the food product in different forms such as hydrogenated vegetable oil or lard. Foods might include crackers, cookies, oils, frozen foods, and others. Divide class into groups and have the students identify the sources of fat in the foods. Discuss the information as a class. KEY QUESTIONS: In which foods can one least expect to find fat? What popular foods in the American diet contain high proportions of fat? What foods might offer acceptable alternatives to these foods which would help people reduce their fat consumption? How could people learn to like the low-fat alternatives enough so that they eat them instead of the more popular foods? What are some strategies to reduce calories and fat in the diet?

Have students plan a one day low-fat menu for a teenager and for an adult. Refer to Teaching Aid 9, Create a Low-Fat Menu, as an example of a menu which should be adjusted. Analyze the menus, if possible, using a dietary analysis computer program. Make corrections if needed.[B]

Have students read resources regarding sodium in the diet, the importance and function of sodium, food sources, and potential problems that can result from excessive consumption of sodium. Then, divide the class into groups and have the groups plan a three day menu focusing on a low sodium diet. Have the groups determine the amount of sodium included in the menu. Then have the students make recommendations for alternate foods which could be substituted or added that would decrease sodium in the menu. Analyze the diet using a dietary analysis computer program. If necessary, make corrections in the planned diet. KEY QUESTIONS: What are some strategies for reducing sodium in the diet? What are some strategies for reducing calories in the diet? What problems may be prevented by reducing sodium in the diet?[B] [C]

[B] = Basic Skill Reinforcement

[C] = Common Essential Element

Have students read resources regarding sugar in the diet, the importance and function of sugar, food sources, and potential problems than can result from excessive consumption of sugar. Then, divide the class into groups and have the groups plan a three day menu focusing on a low sugar diet. Have the groups determine the amount of sugar included in the menu. Then have the students make recommendations for alternate foods which could be substituted or added that would decrease sugar in the menu. Analyze the diet using a dietary analysis computer program. If necessary, make corrections in the planned diet. KEY QUESTIONS: What are some strategies for reducing sugar in the diet? What are some strategies for reducing calories in the diet? What problems may be prevented by reducing sugar and calories in the diet?[B] [C]

Have students read resources regarding fat in the diet, the importance and function of fat, food sources, potential problems that can result form excessive consumption of fat, and the need for a sensible exercise program. Then, divide the class into groups and have the groups plan a three day menu focusing on a low fat diet. Have the groups determine the amount of fat included in the menu. Then have the students make recommendations for alternate foods which could be substituted or added that would decrease fat in the menu. Analyze the diet using a dietary analysis computer program. If necessary, make corrections in the planned diet. Have students plan a sensible exercise program for a person who is on a low fat diet and of a specific size. KEY QUESTIONS: What are some strategies for reducing fat in the diet? What are some strategies for reducing calories in the diet? By reducing fat in the diet, what will this promote or prevent? What are the advantages of individuals participating in sensible or reasonable exercise programs? What precautions should individuals follow prior to participation in exercise programs?[B] [C]

Lead a class discussion and differentiate between the allergic reactions to milk and milk products which are more common in young children and milk or lactose intolerance which occurs among adults. Provide labels from a variety of foods, including infant formulas, and have students identify those which contain milk. Have students develop a menu for a breakfast, lunch, or dinner for an 18-month-old child or for an adult. Shuffle the menus and redistribute them, having each student alter the menus to eliminate items which contain milk or milk sugar as ingredients.

2. Pregnancy and dietary needs

Assign groups of students to review library or classroom resources on the importance of selected vitamins, minerals, and

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[B] = Basic Skill Reinforcement

[C] = Common Essential Element

macro-nutrients in the diet of the pregnant woman. In addition to a comprehensive list of vitamins and minerals, include protein, carbohydrates, fat, and water among the nutrients to be studied. Ask each group to respond to the following questions about the assigned micro/macro-nutrient. KEY QUESTIONS: Is the Recommended Daily Allowance (RDA) for this nutrient different for pregnant women from the Recommended Daily Allowance for non-pregnant, adult women? What dangers exist for the woman and/or the fetus if levels of this nutrient are insufficient in the diet for extended periods during pregnancy? Are there critical periods during a pregnancy when this nutrient is most essential? What does this nutrient contribute in the growth and development of the fetus? What recommendations might physicians make regarding the pregnant woman's diet so that she ingests adequate levels of this nutrient? What are the common dietary supplements prescribed by physicians to pregnant women?[C]

Provide students with Teaching Aid 10, Basic 1500 Calorie Menu, for a woman who is not pregnant. Have the class suggest changes in the menu which would make it adequate to meet the RDA for a pregnant adult woman. Other menu variations might include changing the menu so that it would meet the nutritional needs of a teenaged pregnant woman or a lactating mother.

D. Retaining nutrients in foods

Have students read library references and other resources related to traditional and newer innovations or trends in retaining nutrients. Lead a class discussion on the importance of retaining nutrients in commercial and home prepared or processed foods. NOTE: Include in the discussion that people are eating more processed foods than in previous years. This is happening due to technology, less time available for preparation, and changing lifestyles. Review traditional methods of retaining nutrients including items such as cooking with lids on pans, covering refrigerated foods, cooking using small quantities of liquids, avoiding overcooking of foods, and avoiding excessive exposure to air. The use of new technology as a method of helping to retain nutrients should be reviewed. Newer technologies and trends should include such items as microwave cooking, wok cooking, or quick freezing.

Invite a local retail food distributor or other resource person to class to discuss methods used by manufacturers to retain nutrients in foods. NOTE: Methods involve quick freezing, dehydration, and chemicals. Have students prepared to ask the resource person questions. KEY QUESTIONS: What are effective ways being used to retain nutrients? Are all processing methods equally effective for nutrient retention? Why or why not? What methods

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are being used in industry which are similar to food preservation methods used in homes? NOTE: Information for proper cookery for nutrient retention may be found in the food and nutrition unit in the *Comprehensive Home Economics* course curriculum guide and in the appropriate section of the *Food Science and Nutrition* technical course curriculum guide available from the Home Economics Curriculum Center, Texas Tech University, Lubbock, Texas.

Lead a discussion on the preparation and storage techniques which are appropriate for foods containing high concentrations of particular vitamins. Following the review session, have students participate in several rounds of a game in which an answer to a question is stated and students state the question which fits the answer. For example, the leader of the game might state an answer such as "Oxidizes when exposed to light and air." An acceptable answer would be "What is Vitamin C or ascorbic acid?" Rather than having the teacher state all of the answers in the rounds, the class could be divided into teams which would develop sets of answers (reviewed by the teacher prior to the game) and alternate with other teams stating their answers and providing possible answers, gaining points for correctly responding and for providing an answer for which other teams could not identify an appropriate question.[C]

E. Assess safety factors of food additives
   1. Classification of food additives

Have students to view audiovisuals on food additives. Discuss with students highlights of the audiovisuals. Define *food additives*. KEY QUESTIONS: Why are some food additives classified as intentional and others as incidental? What are some examples of each? Which additives are nutritious? Which additives are not nutritious?

Refer to Teaching Aid 11, Food Additive Terminology, to lead a class discussion on food additives and terminology. Have students complete Teaching Aid 12, Food Additives and Their Purpose. Lead a class discussion on preservatives, microbial inhibitors, non-microbial deterioration inhibitors, emulsifiers, anti-caking agents, antioxidants, leavening agents, maturing and bleaching agents, dough conditioners, humectants, stabilizers, thickeners, and texturizing agents, flavoring agents, coloring agents, sweeteners, and nutritional additives. Provide references and assist students to classify as many chemical agents as they can find according to information on the teaching guide. Have students differentiate between chemicals which occur naturally or accidentally in particular foods (incidental additives) and chemicals which are added purposely (intentional additives). Some of the chemical agents may be listed under both columns of the grid.

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As an enrichment experience, have students prepare a bulletin board identifying food additives and some of their uses in the food industry.

As an enrichment experience, have students conduct a taste test using examples of foods that are fresh compared to similar foods with food additives. KEY QUESTION: Are there differences in the appearance, texture, color, or taste of the foods? Explain.

2. Safety assessment
   a. Food and drug administration regulation

Lead a class discussion on the importance of regulating food processing. Identify how governmental agencies regulate the industry. Encourage students to identify the kinds of controls they think should be enforced to prevent hazards to the public. Focus on chemical agents added to foods to enhance their storage life and increase acceptability to consumers. Compare students' suggestions with the controls on the use of chemical additives in food products, reflected in current regulations such as:

* The additive must be proven to serve a necessary or useful purpose.
* The additive effectively performs the function for which it is intended.
* The additive does not conceal decay or disease.
* The additive is generally recognized as safe for human consumption.
* The additive is identified on the food label.

As an enrichment experience, have students prepare a bulletin board identifying laws and regulations governing food additives.

Have students complete a work sheet or study guide which has them describe the Food, Drug, and Cosmetic Act of 1938, the Food Additive Amendment of 1958 (specifically including section 409 of the act–known as the Delaney Clause), and the Fair Packaging and Labeling Act of 1966. Using Teaching Aid 13, Examples of Food and Nutrition Legislation, have students discuss laws which relate to foods. Explain in a lecture how the Food and Drug Administration (FDA) regulates the food and drug industries, including the following:

* Levels of natural filth, pesticides, and poisonous and deleterious substances permissible in foods
* Standards of Identity and Common or Usual Name regulations
* Labeling regulations
* Thermal processing regulations
* Nutritional regulations
* Good Manufacturing Practice regulations

Describe actions the FDA takes to enforce laws and regulations which prohibit the manufacture or selling of adulterated or misbranded food products.

Display to the class sample packaging containers used for cereal, bread, whipping cream, soft drink, milk, chips, ice cream, gelatin, canned soup, candy, mayonnaise, canned fruit, and margarine. Have students examine the ingredient listing on the labels to determine the additives used. Make a list of foods that would be available if all additives were banned. Lead a class discussion regarding the implications such a ban would have on the consumer. KEY QUESTIONS: What changes and adjustments would be necessary to maintain a balanced diet? How might severe limitations of food additives affect food quality or safety?

Have students read resources on the use of food additives in processed foods. Divide the class into groups to debate the pros and cons of using additives in processed foods. Consider the benefits and risks relating to the consumer and the industry. Include cost, health, convenience, and/or variety. After the debate, outline guidelines to encourage safe use of additives.

As an enrichment experience or Student Occupational Activity, have the students examine labels from food packaging and list the additives. Make a chart comparing the food additives in these products. Write the food processing plants or food companies for each of the products. Ask a company representative from each company for information on the food additives in their product. Determine why the chemical substances (additives) are needed and their effects on flavor, texture, and keeping quality.

b. Potential dangers of intentional additives

Provide students with resources which describe the potential dangers of food additives to consumers, including consumer protection journals, books on the role of diet in cancer and other diseases, and governmental agency publications on the safety of generally recognized as safe (GRAS) intentional food additives. Have students give oral reports on their findings, citing specific examples of animal or human studies giving the relationship between the ingestion of artificial sweeteners, food colors, nitrates/nitrites, sugar, or salt in relation to birth defects, cellular mutations including DNA damage, and/or cancer.[B] [C]

Distribute food labels for a number of products which are new to grocery store shelves, including items which are advertised as low calorie foods. Have the students analyze the labels to compile a list of chemical agents commonly added to foods. Using a current listing of safe additives from a FDA publication or other reference, have the students identify additives which appear on the list and those which do not. Lead a class discussion regarding how individuals might find out if an additive not appearing on the list is

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safe for human consumption. Review FDA regulations which permit the introduction of newly developed additives.

View Teaching Aid 14, Percentages of Annual Additive Intakes, showing the annual intake of additives in the United States. Find labels of commonly eaten foods which are high in sugar and salt. Lead a class discussion regarding the effect that sugar and salt have on foods and on the human body. KEY QUESTIONS: What nutritional factors relate to large consumptions of sugar and salt? What are some ways one could reduce their sugar and salt consumption?

Have students study food labels to compile a list of minerals and vitamins which are often added to foods. KEY QUESTIONS: Which foods are enriched with these nutrients? Why is it important for these foods to be enriched? What are some other foods that might be nutritionally enriched with additives in the future? Why should the foods have nutrients added? What are the disadvantages of adding nutrients to more foods?

F. World food supply

Have students brainstorm to formulate a list of problems involved in feeding the world's population. Include the increasing world population, underdeveloped countries, pollution, food taboos, problems in providing enough protein foods, and ignorance. KEY QUESTIONS: How can the problems be solved to help ensure adequate food for the world's population? Which problems are the easiest to solve? Which are the most difficult? Why or why not?

Have students work in groups to study references on the following factors as they relate to supplying food to meet the nutritional needs of the world: increasing world food production, nutrition education, traditional value systems, social organizations, land ownership and tenure relationships, political climate, lack of income, transportation and storage facilities, superstitions, customs, religion, and illiteracy. Have students report their findings to the class.[B] [C]

Have students view audiovisuals on new technologies and trends in agricultural capabilities, food production, supply, and marketing, disasters, and other factors affecting the world food supply. Lead a class discussion regarding the audiovisuals.

Have students read library references and other resources related to technological improvements and advances in agricultural capabilities and food production, supply, and marketing. Lead a class discussion regarding the technological advances related to

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food production, supply, and marketing. NOTE: Include information on topics such as biotechnology, genetic engineering, and aquaculture. KEY QUESTIONS: How has technology improved food production in the United States? How have U. S. food quantities and quality improved? What are some of the new agricultural and food production technologies that are emerging? What are the anticipated roles of these technologies in the future of the American food supply? What are the anticipated roles of these technologies in the future of the world food supply? Due to American technology and ingenuity in food production and food supply, what poor American food habits have been or are being transferred to other nations? (For example, the American desire for fast foods is resulting in the expansion of some fast food franchises to other nations.) Will this example of transfer of technology and potential changes in eating habits transfer to other nations resulting in increased fat, sodium, sugar, and caloric intake in those countries? What are other examples of technologies that have transferred to other nations? Which of these will have desirable effects and which will have potentially undesirable effects? What are the advantages and disadvantages of improved technology? How can the disadvantages created by the technologies be minimized both in the United States and in other nations?

1. Technological factors
    a. Agricultural capabilities

Obtain current resource materials from the library and other sources which describe advances in agricultural production, methods, and equipment. From these references have students read about and be ready to identify various advances which have the potential for increasing the world's food supply in quantity or quality. On the chalkboard, create two vertical columns, labeling one "Improvements in Quantity" and the other "Improvements in Quality." Have the students identify an advance and determine the appropriate heading under which to list it. Have each student who identified a particular advance respond to the following questions, based on his or her readings. KEY QUESTIONS: What new human or material resources will be required to make this agricultural advance be successful? (More training for agricultural workers, more energy in the form of fuel, or more land for production) What effect did the resource indicate this advance might have on the world's food supply? How soon will this effect have a significant impact on food production?[B]

Invite an agriculture teacher, farmer, horticulturist, agricultural extension agent, or botanist to class to describe how food and/or plant production methods have changed and improved over the past decade. Have students prepared to ask the resource person questions.

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CONCEPTS	LEARNING AND EVALUATION EXPERIENCES
b. Ecological effects on food supply	Refer to resources which provide lists of major disasters throughout the world which have caused major loss of human life. Lead a class discussion regarding the causes and consequences of major disasters and hypothesize how the food supply to an area of the world might have been disrupted in relation to this disaster. Consider food production and distribution problems which may have precipitated the disaster or have been the result of its occurrence. Determine which of these disasters was man-made and which were the result of an ecological imbalance (such as a drought) or other natural occurrence (such as an earthquake or tidal wave). KEY QUESTION: How has drought or other disasters affected the world food supply and the nutritional well-being of people?
2. Social factors a. Regulation of food consumption b. Population growth and demand c. Affluent nations and their resources	Lead a class discussion regarding information on the societal/cultural patterning of food consumption, including examples of governmental regulations which reflect socio-political values of particular groups of people or countries. Describe how society and laws affect the aspects of food consumption. Some items to discuss are the following: 1) how food is acquired, including the country's food which is imported and the nature of the country's own agricultural production; 2) which foods are prohibited, where religious laws about foods which may be eaten cause the government to restrict imports/production of certain foods; 3) how religious laws influence which foods may be eaten or restricted for importing or producing; 4) how foods are prepared, including religious restrictions on methods of preparation and governmental regulation of standards of cleanliness in food service establishments; 5) who prepares food and serves it, including societal or regulator requirements on persons who cook and/or serve food; 6) who is allowed to eat certain foods and with whom they may eat, such as in some countries societal customs do not allow women to eat in public restaurants and discourage them from eating at the same table with men at home; and 7) when certain foods are eaten and in what quantity, including time preferences for service of larger meals and traditional time schedule for various meals (when lunch and dinner are traditionally served, for example). Following the discussion, have each student select a country, research, and write a report on the food patterns of the people in that country. Have one section of the paper devoted to a discussion of how the country's food consumption patterns may affect the world's food supply. For example, a tradition of eating

whale meat has an important influence on the worldwide population of whales. Another example is the demand for coffee, which influences tropical countries to grow coffee for export rather than using the arable land to grow food crops for people in the countries. Evaluate students' reports based on content and effective communication skills.[B] [C]

Provide students with tables showing the current population, population growth rates, and level of agricultural production in animal and plant products (which people can eat) of major countries throughout the world. Have the class rank the countries according to those which will have the largest populations within the next decade (if trends continue), which ones will have experienced the fastest rate of population growth over the next decade, and which ones produce the largest quantity of food which could be used to feed their own populations. After discussing the rankings, determine as a group where trouble spots might occur in the world as a result of high populations, growth rates, and lack of food.[B]

Have students complete the work sheet found in Teaching Aid 15, Allocation of Major Sources of Food Energy in the Diet. Have them share with the rest of the class their own "My Diet" calorie totals for the world's population if all five billion had daily diets like their own. NOTE: Point out and explain that the American population, which represents six percent of the world's population, consumes approximately 51 percent of the total annual production of plant sources of calories (grain), either through direct consumption of a grain product or by eating animal sources of calories, which are fed with calories from plants. Explain that animal sources require approximately ten calories from plant sources to produce one calorie of food energy. Lead a class discussion on the implications of feeding a growing world population. KEY QUESTIONS : How would the agriculture and fishing industries in the United States (and other countries which sell animal products and fish to the United States) be affected if there was a substantial reduction in the demand for meat, poultry, and fish? How would the health of the American population be affected if it became necessary to reduce consumption of animal sources of food energy to much lower levels? What nutritional adjustments would become necessary? CRITICAL QUESTIONS : If the entire world's population could be guaranteed sufficient food energy by following a diet like Diet C from the work sheet, would the students in this class be willing to reduce their daily intake of calories from animal sources to the ten percent level? Why or why not? Would all Americans be likely to accept this

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kind of reduction in their intake of food energy from animal sources? Is it fair or equitable for people in developed countries, like the United States, to stimulate worldwide agricultural production of animal sources of food energy, thus reducing the amount of the world's available supply of food energy from plant sources?[B]

Lead a class activity according to the procedure described in Teaching Aid 16, Sharing the World's Food Energy. After the activity, divide the class into groups according to the amount of food received, placing the animal into the group of people which received an equal amount of food. Have each group discuss and agree upon their responses to the following questions. KEY QUESTIONS : Did you receive an adequate proportion of the total amount of food available? How do you think persons in other groups could be convinced to share more of their food with those in your group? Does the person who represents the farm animal have a right to bargain for some of the food? Reassemble the entire class and share the responses of each small group. CRITICAL QUESTIONS: What would those in your group do if those who received the smallest amount of food would die if they did not obtain a greater proportion of the food? What if those who received the largest proportion of the food would become malnourished if they were forced to reduce their consumption? If one group has enough money to convince agricultural producers to sell food to them instead of to a poorer, but less well nourished group, is money an equitable basis for the decision? Does this activity reflect the nature of food distribution in the world today? What could be done to make certain that the entire population of the world receives food which meets everyone's nutritional needs?

G. International organizations for improved nutrition
   1. Food and Agriculture Organization
   2. World Health Organization
   3. Other organizations

Provide copies of Teaching Aid 17, Preamble to the Constitution of the Food and Agriculture Organization (FAO). Focusing on the phrases in italics, lead a class discussion regarding how an organization which is concerned with food and agriculture can take actions which would:

1) raise people's levels of nutrition,
2) raise people's standards of living,
3) improve the efficiency of production of food and agriculture products,
4) improve the distribution of food and agriculture products, and
5) better the conditions of rural populations.

Encourage the students to cite examples of actions such organizations have taken over the past 50 years or so which have accomplished these goals. Examples might include educational programs which have taught people to eat foods which will

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provide a better daily nutritional balance; enrichment and fortification of foods common in the daily diet of people in different parts of the world; the development and use of pesticides and fertilizers which permit greater agricultural production; food distributions programs in countries experiencing drought and famine; and improvements in roads for trucking and air transport systems so that rural populations in hard-to-reach areas of the world can receive adequate food supplies.

As an enrichment experience, compose a letter to a United States congress person who represents the state or local region to request information about the involvement of the United States in international organizations which have food and nutrition programs, such as the Food and Agriculture Organization. The class might ask the congress person about his or her concerns.[B]

Provide students with Teaching Aid 18, Program Goals of the World Health Organization (WHO). Divide the class into groups and have each group take one of the goals from the list to investigate in greater detail. Using dictionaries, nutrition science texts, medical/health guides for lay persons, and other references, have each group of students prepare to explain the meaning of a goal by paraphrasing it in simpler language. In addition, help the students hypothesize about how the goal could be implemented through specific activities of the organization and to describe how it would improve the health of people around the world if it was successfully accomplished. Have each group select a reporter to explain their conclusions to the rest of the class.[B] [C]

Refer to current compilations of names of national and international organizations available in the reference area of the library. Obtain the assistance of the librarian to identify organizations which conduct programs which distribute food, assist with agricultural production, or seek to improve the nutritional status of persons in various countries. Have each student independently identify at least three organizations other than the FAO or the WHO and list them on a chart or poster in the classroom, attempting to identify as many different organizations, the countries or regions of the world they serve, and their major program activities as possible. KEY QUESTIONS: Are there organizations which appear to have programs that duplicate efforts in a given country or region of the world? What kinds of programs are most common among the organizations listed? What are the least common types of programs? CRITICAL QUESTIONS: If all of these organizations are conducting programs which are intended to address the food and nutrition

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needs of people around the world, why have their efforts not been entirely successful? Why does famine continue to be a serious problem in many Third World (underdeveloped) countries?

Have students view audiovisuals or study references to determine what various nutrition organizations are doing to solve the problems in supplying food to meet the nutritional needs of the world. Lead a class discussion regarding ways that increasing agricultural productivity, improving animal production, and obtaining food from the sea may help meet the world's nutritional needs. KEY QUESTION: How have the various efforts of nutrition organizations affected world nutrition?

As an enrichment experience, divide students into groups and have each group chose a leader and recorder. Have groups study newspapers and periodicals to identify organizations working to improve world nutrition. Examples: Food and Agricultural Organization; World Health Organization; United Nation's International Children's Emergency Fund; United Nation's Educational, Scientific, and Cultural Organization; Agency for International Development; Nutrition Foundation; and the United States Interdepartmental Committee on Nutrition for National Development. Have each group select two organizations and research information on the history and goals of the organizations, parts of the world they are serving, types of assistance they are providing, target populations, and sources of funding. Each group should report their findings to the class.[C]

H. Nutrition and world progress
   1. World hunger problem
   2. Food trade policies

Have the students read individually or ask for a volunteer to read aloud Teaching Aid 19, Living the Life of the One Billion Poorest in Our World. Lead a class discussion regarding the factors or circumstances which a contribute to the low nutritional status or chronic state of malnutrition and hunger of the poor throughout the world. Write the words "World Hunger" in the middle of the chalkboard. Draw a circle around the words. Begin by listing one or two factors around the circled words, and circle them as well. As students suggest factors during the discussion process, ask them to indicate whether their ideas relate to any of the other factors already on the board. Encourage them to explain why these ideas are related. Connect related ideas with lines and cause-effect arrows if possible. When as many factors as possible are listed on the board, have the students address the following questions. KEY QUESTIONS: Which of the factors are caused by nature, such as weather conditions? Have any of these factors been affected by people? in what ways? Can people change any of these natural factors? How? Which of the factors are caused primarily

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by people, including governments? Which of the factors are currently being addressed through the actions of private or public organizations? Which ones? Which of these probably will be solved by single nations on their own? Which will require the cooperation of many nations? Which of the factors could be addressed more adequately with the assistance of the United States? How might worldwide malnutrition and its associated problems be eradicated?[B]

As an enrichment experience or as a Student Occupational Activity, have students research nutritional deficiencies in selected underdeveloped countries. Have students give a written report of the research findings including the types and frequency of occurrence of the nutritional deficiencies. Evaluate the reports on content and communication skills. KEY QUESTIONS: What food relief or nutritional programs have been implemented in the identified underdeveloped countries to help alleviate nutritional deficiencies? Is there evidence of the effectiveness of the food relief programs?[B] [C]

Invite a resource person from the agricultural community to class to discuss world food trade policies. Have the speaker include up-to-date information on exporting or importing grain, beef, coffee, tea, bananas and other foods. Have the students prepare questions to ask the resource person. NOTE: If a resource person is not available, have students read library references or other resources on world food trade policies. KEY QUESTIONS: Who benefits from exporting and importing food and food products? What are the disadvantages of importing foods and food products? What are the reasons for importing and exporting food products?

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TAC 75.83
ADVANCED FOOD SCIENCE AND NUTRITION
UNIT II

COMPETENCY: (j.2) *Concepts and skills related to food processing and marketing.*

SUB-COMPETENCIES:

(A) *Summarize the scientific and creative aspects of food processing and marketing.*

(B) *Outline safety and sanitation considerations for food processing and packaging.*

(C) *Assess methods for processing foods.*

(D) *Analyze the impact of processing on product quality, nutrition, and taste.*

(E) *Discuss chemical reactions that occur during food processing.*

CONCEPTS

II. Food processing and marketing
  A. Scientific and creative aspects
    1. Technology of food processing and marketing

LEARNING AND EVALUATION EXPERIENCES

NOTE: There are several laboratory experiences suggested in this unit. Teachers should review with students the appropriate content on safety and sanitation in the food and nutrition unit in Comprehensive Home Economics and the appropriate materials in the Food Science and Nutrition technical course before beginning the laboratory activities.

Define the term *technology*, explaining that a technology has to do with the combination of techniques and tools or instruments which permit one to accomplish a task. Have students trace the history of the technology of bread making, using library and classroom resources. As an enrichment experience, students may prepare various recipes for bread, including unleavened bread; whole wheat, white, rye, sourdough, and potato bread; and fortified bread, containing high protein additives. Have the students chart the ingredients, tools, and techniques used in the production of bread from each of several recipes. Discuss with students how advances in the methods of refining grains and the discovery of high quality bread yeast which could be dried or stored for extended periods probably contributed to the large-scale commercialization of yeast breads.

Have students research to identify recent technological advances related to food. Sources of information may include local, state, and federal health departments, county extension offices, state land grant universities, newspapers, and magazines. Share the information with the class. Lead a discussion in class on the technological advances related to food.

Have students study resources to find information about technological advances in biotechnology and food fabrication technology. Have students view Teaching Aid 20, Fabricated Food Products, for examples of foods which have been developed through recent technology. Assign students to write reports on biotechnological applications which have permitted the development of new, natural substitutes for artificial additives in foods, the alteration of genes in plants which change the properties of fruits and vegetables, the creation of digestible foods from formerly indigestible plant products, and the alteration of genes in animals which changes the properties of meats, eggs, and other animal products. Have other students write reports on the fabrication of new foods, including surimi, sucrose polyester, and high quality proteins from incomplete protein sources. Have the students give oral reports on the technological advances described in their written reports.[B] [C]

Have students view audiovisuals on new technologies used in food production and food processing. Lead a class discussion on the new technologies used in food production and food processing.

As an enrichment experience, have students prepare bulletin boards identifying and explaining new technologies in food production, processing, or marketing.

Display in class a variety of packaged foods using a variety of packaging technologies. Have students identify technologies including aseptic packaging. Identify the packages and have each student evaluate the types of packaging techniques and packaging materials. For each product, the students should identify the nature of the packaging, the expiration date, and the cost of the product. Lead a class discussion on the most prevalent forms of packaging identified, other foods packaged using the technologies, the relationship of new packaging technologies to food product cost, and possible advantages and disadvantages of each type of packaging.

Collect current articles from magazines, newspapers, research journals, and manufacturers' pamphlets to obtain information on technological advances which will affect the availability and consumption of food. Lead a class discussion on the articles. NOTE: Technological advances might include: retort pouches; sterile, antiseptically packaged milk and milk products; shrink wrap for perishables; modified atmosphere packages for fish; and bag and box techniques for precooked meats.

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Have students view audiovisuals on new food packaging technologies. Lead a class discussion on the advantages and disadvantages of the packaging materials and methods.

Define the terms *artificial, fortified, formulated, synthetic foods*, and *meat analogues* having students use reference materials. Using resource materials and periodicals, students could identify examples of synthetic foods and their uses. Determine the acceptance of the synthetic foods by surveying consumers. Report the survey findings to the class.

Display various synthetic and substitute foods, such as diet foods, infant formulas, and textured vegetable protein. Lead a class discussion on the advantages and disadvantages of each food, the nutritive value of each, storage requirements, cost, and availability. KEY QUESTIONS: How do the foods differ from the foods they have replaced? For what populations were the foods developed? What difficulties might have been encountered when the food was introduced on the market?

Exhibit a collection of current advertisements for synthetic foods. Have students research the availability, price, and nutritive value of each synthetic food. Lead a class discussion on the advantages and disadvantages of including the foods in one's diet. Advertisements might include synthetic salt, protein, sugar, and butter.

As an enrichment experience, have students select a method of food processing to research. Write to a food processing company for information concerning the processing method. Draw a flow chart showing the various steps involved in the processing. Share the flow chart with the class by making a copy of it. In a report to the class, explain why each step is important.[B]

Lead a class discussion on the effects and the advantages and disadvantages of food processing on the nutritional value of foods. Discriminate between the terms enrichment and fortification. Compile lists of food products that are enriched and fortified. KEY QUESTIONS: Why are enrichment and fortification processes necessary? What might be the potential short-term and long-term influences of enrichment and fortification on the nutritional well-being of individuals?

Divide the class into groups to trace the steps a processed food goes through on its way to the consumer. Determine how the food is grown, harvested, transported, processed, packaged, stored,

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and distributed. Have students present their findings to the class in the form of a poster, bulletin board, or chart.[B]

2. Product development

Have students view audiovisuals on food product development or if available ask a resource person from business/industry to discuss product development with the class. KEY QUESTIONS: Why has the number of new products increased due to technology? What major food products have grown in numbers more than others? Why has the growth occurred in the particular categories? How well does the public accept new products?

As a Student Occupational Activity, have students interview local grocery store managers to identify some new food products on the market. Have each student write an analysis of the products selected. The written analysis should describe the appealing features of the product, the student's opinion about the type of consumer who would be most likely to buy it, suggestions for improvement if any, and a price comparison of the product with comparable products from other companies. Have students share their findings with the class and explain which of the new products appeared to be the most unique or original in design or in function.[B] [C]

Have the students write letters to the consumer departments of companies which manufacture food products, indicating that, as students in an advanced food science and nutrition course, they are interested in learning more about how food products are developed. Have the students request information from the company. When individual students begin receiving responses, have them share the company's comments about product development.[B] [C]

Contact different industrial firms and/or businesses to acquire audiovisuals on product development, packaging, and marketing. Lead a class discussion on the audiovisual information on product development, packaging, and marketing.

Have students assume they are scientists or entrepreneurs producing a new food to meet the needs of individuals with eating difficulties. Interview people with special needs to determine what kind of foods are needed. Needs might include problems relating to physical handicaps, nutritional needs, financial difficulties, or limitations in eating environments. Write a brief description of the new food product and a justification for producing that particular product.[B]

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As an enrichment experience, invite a nutritionist, or other resource person to class to discuss the differences between natural and synthetic foods. Ask the resource person to explain the procedure that businesses go through to develop synthetic foods. Compare the chemical, nutritional, and economical differences between some natural and synthetic foods. Have students prepare questions to ask the resource person. NOTE: After students acquire the knowledge and skills identified in Unit III of this course, conduct a laboratory experience promoting critical thinking on product development.

3. Creative marketing techniques

Lead a class discussion on product marketing, defining the term *marketing*, and describing how a product can be marketed effectively in different ways. Have students view Teaching Aid 21, Ways to Market a Product. During the discussion, encourage the students to identify products which are memorable because they have been marketed using one or more of the techniques listed in the teaching aid.

Have students to view audiovisuals on food marketing techniques. KEY QUESTIONS: Can one tell the marketing population, such as age group or sex, for which the strategy has been targeted? Why? Why not? What other marketing strategies are visible?

Assign students to visit a retail store which sells vitamin and mineral supplements. Have each student select one product which appears to be marketed in some unique way. Have them copy the name and the major words from the label of the product (not including a complete listing of specific vitamins and minerals, amounts, and percentages of the Recommended Daily Allowance of each contained in the product). If additional advertising is available regarding the product, have them obtain a copy and bring it to class. Ask them to record the price and number of doses contained in various sizes of the product. Finally, have them identify three specific vitamins or minerals which are contained in the product in the highest concentrations, recording the percentage of the RDA provided in one day's dosage of the product. Conduct a group analysis of the various labels and advertisements, identifying commonalities among the words on the labels and the various advertising pitches. Lead a class discussion on the probable accuracy of the nutrition claims and the dangers of megadoses of specific vitamins and minerals. Review the unique marketing strategies used for some of the products.

Research reliable sources to obtain information about future plans for new food products. Have students assume that they are in charge of marketing one of the foods in the U.S. market. Predict the acceptance of the new food by the consumer, processors, and government. KEY QUESTION: What problems may be encountered? Have students prepare a presentation to introduce the product to the consumer. Lead a class discussion on the benefits and shortcomings of the product. NOTE: Sources might include dietitians, research departments of companies and universities, agricultural extension agents, home economists, Food and Drug Administration, and United States Department of Agriculture.

Have students view audiovisuals on food processing and food processing plants. Determine how food is processed or manufactured, stored, packaged, and shipped. KEY QUESTIONS: What kind of machinery is used in food processing? What jobs do employees do? How is the safety and quality of the food product controlled within the plant? How is the finished food product packaged, stored, and handled?[C]

B. Safety and sanitation
  1. Contamination
    a. Environmental contaminants
    b. Packaging and processing
    c. Storage and handling

Provide copies of Teaching Aid 22, The HACCP System of Classification, which outlines the hazard analysis critical control point procedure (HACCP) used by the Food and Drug Administration to inspect food production plants and food distribution outlets for possible sources of contamination in food substances. As a group, identify one or more foods which could become contaminated or suffer significant quality losses during each of the critical control points represented by the three categories. NOTE: For example, some raw fruits or vegetables or meats may be contaminated by pesticides or other toxins prior to processing, causing a hidden hazard to the consumer. When certain foods are processed at home, the use of preservation techniques which fail to kill dangerous microorganisms such as a hot water bath instead of pressure canning methods for preparing green beans may cause a significant hazard when the food is served. Finally, some retail outlets fail to make certain that foods which are frozen are kept frozen during the stocking of freezer cases. When these foods are allowed to thaw and are subsequently refrozen, there can be a noticeable loss in the quality and a potential health hazard to the unsuspecting consumer who buys the product.

Show Teaching Aid 23, Temperature of Food for Control of Bacteria, to students. Have students read references on botulism, other food contaminants, and procedures food processors observe to prevent food contamination and ensure quality. Determine sanitation and safety practices to prevent botulism and other types of food contamination when preserving foods. Summarize the findings by writing a list of guidelines to follow when canning, storing, and handling food. KEY QUESTIONS: What procedures do food processing plants observe to reduce or prevent food

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[C] = Common Essential Element

contamination? What is quality control? How do food processors ensure quality control? Why is it important?[B]

C. Assess methods for processing foods
   1. Chemical preservation methods

Use resources from the library and texts on food to provide students with a historical perspective on the importance of chemical preservation methods of food to the survival of humankind throughout the ages. Divide the class into small groups to conduct further research and describe the basic chemical preservation methods to the class through an oral report. For example, one group could study fermentation processing, whereby natural organisms are encouraged to grow in or microbial cultures are added to various foods to preserve them, as in the making of cheese, bread, olives, pickles, wine, and vinegar. Other groups could investigate the historical origins of food preservation through salting, sugaring, or the addition of high acid mediums such as vinegar.[C]

Invite a resource person to speak to the class, and/or provide references which will help students learn about the most common methods for the preservation of foods through the use of chemicals. These methods should include the use of citric acid or vinegar to change the pH in foods, and the preservative effects of the addition of nitrite, sorbate, benzoate, propionic acid, and propylene glycol. Develop a study guide or work sheet which will have students to describe the purposes of the major chemicals used in food preservation and how they work in retarding spoilage or retaining color, flavor, and the physical integrity of food products. KEY QUESTIONS: Do some chemicals promote a health hazard? If so, which ones and under what conditions? How has chemical preservation of foods helped to ensure an adequate supply of food in the United States?

Have students to view audiovisuals on chemical preservation of foods. Lead a class discussion on the audiovisuals. KEY QUESTIONS: What chemicals are commonly added to foods as preservative agents? What are the purposes of the various chemicals used in food preservation? What are some foods and the chemicals used in the preservation process? Which chemical agents are best suited for commercial use and which ones are best suited for home preservation use?[B]

As an enrichment experience, have students prepare a bulletin board or display indicating chemical food preservation agents that are used. Identify examples of foods containing the chemical agents.[B]

[B] = Basic Skill Reinforcement

[C] = Common Essential Element

2. Processing methods

NOTE: Section D, Impact of Processing, in this unit may also be considered along with the following experience. Using Teaching Aid 24, Preservation of Foods, lead a class discussion on the commercial and home methods of canning, freezing, and drying/dehydrating foods. Include information on scientific methods which each method is based. Explain agents and processes that are used to preserve foods. Compile a list of factors that affect the method used when preserving foods. NOTE: Possible factors might include availability of fresh products; amount of food to be preserved; water content of food; acidity of food; maturity of product; quality of product; cost of process; family food preferences; family nutritional needs; and availability of equipment, space, time, and energy.

Display equipment and packaging materials needed for canning, freezing, and drying/dehydrating foods. Categorize the items according to the type of preservation method with which they are used. Have students determine how to operate the equipment by watching a demonstration and reading manufacturers' directions. Explain why certain packaging materials are more suitable than others when preserving foods.

Working in groups, have students prepare a presentation to illustrate the various methods to preserve a selected food in the home. Compare the preparation steps, time, equipment needed, and cost of each method. What changes take place in the food's nutritive value, color, shape, texture, and flavor. Present the findings on displays, posters, bulletin boards, or charts.[C] [B]

Participate in a taste comparison of dried/dehydrated foods. Taste samples of fresh and dehydrated fruits, vegetables, and meats. Compare the food products on taste, texture, palatability, color, and cost. Lead a class discussion on the steps in dehydrating foods with a dehydrator, a conventional oven, and the sun. Outline the advantages and disadvantages of each method. Have students dehydrate fruits and vegetables using the most suitable drying/dehydration method.

Purchase several processed forms of food items which can be compared in appearance, flavor, and palatability. NOTE: The food selected should be available in canned, frozen, dried/dehydrated, and irradiated forms. Possible food items are various meat products or milk. If milk is not available in frozen form, freeze a small container for demonstration purposes. Use evaporated skimmed milk as the canned form of the product. Have students use Teaching Aid 25, Processing Methods-Rating Scale, to

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[C] = Common Essential Element

[B] = Basic Skill Reinforcement

compare the desirability of the different forms of the products through an analysis of taste and appearance. Lead a class discussion on the differences and similarities among the various forms of the products, comparing the cost per unit (ounce or gram), shelf life, and storage requirements in terms of space and equipment. Select the best methods of preservation across food products and for each specific food according to criteria established by the class.

Have the class use canning, freezing, and dehydration methods to preserve one or more food products. As each process is employed, have the students following it record and time the steps of the process, preparing a task analysis of the entire process from beginning to end, including final preparation of the food for service. Compile the major components of each process, with preparation times, on a chart which can be used to assess the positive and negative aspects of the preservations methods as they are conducted in the typical household kitchen. Lead a class discussion on the advantages and disadvantages of the use of these methods for increasing the shelf life of food products which can be home-grown or purchased in large quantities and preserved inexpensively at home for long-term availability of foods.[B]

Lead a discussion on the methods of food preservation which can be used to increase the storage life of various foods. Discuss with students the techniques employed in preservation by irradiation, freezing, canning, smoking, and dehydrating; and using additives for preservation, such as salt, vinegar, or sugar. Demonstrate several methods using the same vegetable or fruit. Alternately, have the students use various methods to preserve several kinds of foods in the food preparation laboratory, comparing results in terms of quality after a period of time. For example, students could dry sliced cooking apples in a dehydrator, pressure can apple slices, and freeze unbaked apples to be baked later. After a few weeks, have a quality comparison laboratory serving rehydrated apples, warmed canned apples and sauce, and apple cobbler. Students could compare appearance, color, and texture of apple slices preserved using each of the methods.

Invite a resource person to class to discuss commercial methods of food preservation. KEY QUESTIONS: Are those methods similar to the food preservation methods used in the home? Why or why not?

As a Student Occupational Activity project, have students select a preservation method which they can perform at home. Have them plan for the use of the preserved food on a regular basis and keep

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[B] = Basic Skill Reinforcement

a record of when the food is served and the family's reactions to the food. A cost report could be submitted, showing how much it cost to purchase the food product and the cost of preservation including the storage containers.[B]

Have students view audiovisuals on food processing methods used in industry and/or homes. Using Teaching Aid 26, Processes for Preserving Foods, lead a class discussion on the audiovisuals. KEY QUESTIONS: What are the major food processing methods used in the United States? What are the steps in each processing method? What precautions are taken to ensure good sanitation, safe processing, handling, and storage practices, and quality food products?[C]

Have students study references on preservation of foods by freezing. Divide the students into groups. Work in groups to prepare and freeze fruits by several different methods, such as dry sugar pack, pectin pack, syrup pack, unsweetened pack, and liquid pack. Label each container with the method used. After several days, thaw and taste the foods. Compare the color, texture, flavor, appearance, and cost. Lead a class discussion on the kind of anti-darkening agents used in each method. KEY QUESTIONS: What processes should be followed to freeze vegetables? breads and cereals? meats, poultry, and fish?

3. Packaging materials and processes

As a demonstration on packaging, gather various materials which can be used in the household kitchen for storing foods, including plastic bags, aluminum foil, plastic wraps, waxed paper, plastic containers designed for storing a variety of different foods, glass containers, metal cans, and wooden containers for use with breads or crackers. Display several foods and ask the class to suggest appropriate containers or packaging for each food. Follow the recommendations for the appropriate storage technique if it is feasible. Using Teaching Aid 27, Food Packaging, ask students to explain their reasons for choosing particular storage containment methods. For items which the students do not know the best storage methods, demonstrate and explain an appropriate method. NOTE: Emphasize that certain methods of storage can accelerate ripening, such as in packaging unripe bananas in polyethylene bags which entraps sufficient ethylene gas, causing the desired degree of ripening. Explain why opaque packaging is desirable to shut out ultraviolet light which causes lipid oxidation and can destroy riboflavin and vitamin A in milk and pasta products. Focus on various packaging techniques which can be done at home or are used commercially to retard spoilage by microbes, pathogenic organisms, external chemicals, or pests. KEY

[B] = Basic Skill Reinforcement
[C] = Common Essential Element

QUESTIONS: Does packaging include the entrapment of desirable odors and flavors? Does packaging protect a product from physical damage during handling? Can packaging be used as a method for cooking and easy handling of foods? Can packaging be used as a source of information about cooking methods, ingredients in the product, nutrients, and advertising?

Obtain and show audiovisuals showing the processing and packaging of various foods, such as fish (canneries), sugar cane sugar beets, meats, poultry, milk or other dairy products, or frozen entrees. NOTE: Many manufacturers produce audiovisuals and make them available for free loan. If there is a food processing plant in the local area, request a tour of the facilities so that students can see the mechanical and chemical methods of food processing, packaging, and preparation for transport.[B] [C]

D. Impact of processing
  1. Food changes during processing
    a. Effects of processing methods on food quality

NOTE: Section C.2, Processing Methods, in this unit may also be considered along with the following experience. Work with the class to develop a set of laboratory experiments to examine the effects of several food processing methods, including pressure canning, freezing, drying/dehydrating, and pickling. Use vegetables, fruits, and meats which can be obtained fresh and use them at the peak of freshness in the experiments. Have students evaluate the quality of the foods using several objective methods, such as weighing of liquid and solid components of the foods prior to processing, immediately after processing, and after a suitable storage period in appropriate packaging. Teaching Aid 28, Food Product Evaluation, may be used as one method for assessing products. NOTE: Rating scales for assessing the effects of the processing method on appearance, color, flavor, and texture could be developed and used in blind comparisons of freshly prepared foods and foods which have been processed for long-term storage. Photography also could be employed for recording the appearance of the food at various stages of processing. Have the students write reports on their findings and include graphs and tables which compile the results.[B]

Have students read references on foods for space travel. KEY QUESTIONS: How is nutrition maintained during space travel? Are foods for space prepared or processed using methods that are different than those used for processing foods for the general population? How?

Have students conduct experiments similar to those described above with commercially processed foods. Have them compare reconstituted foods which are available in dehydrated form, such

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[B] = Basic Skill Reinforcement

[C] = Common Essential Element

CONCEPTS	LEARNING AND EVALUATION EXPERIENCES
	as freeze-dried products sold as lightweight entrees with fresh forms of the same foods. If the students determine that there has been a loss in quality as a result of processing, have them to provide evidence (measurements, rating scale scores, or photographs) which supports their conclusions.[B]
b. Nutrient retention	Lead a class discussion regarding the specific nutrients which can be destroyed by temperatures which are too high or too low, those which leech into water from foods when they are cooked, those which are destroyed by ultraviolet light, those which are sensitive to certain chemicals in additives such as salt or acid, and those which generally are not affected during the standard methods of processing foods. Following the review, have students name specific foods and various food processing methods used either to cook or preserve foods, and identify nutrients common in these foods which would be retained and others which probably would be destroyed or be diminished in quality as a result of a processing method.
E. Chemical reactions of food processing	Lead a class discussion on identifying and defining food processing terms which represent specific processes used in the eight basic food preservation methods (application of heat, exposure to radiation, separation of major components, temperature control, gas environmental control, control of water content, fermentation, and the addition of chemical inhibitives). Using Teaching Aid 26, Processes for Preserving Foods, explain the role of the processes in preserving food for storage or preparing it to be consumed. To the extent possible, based upon students' knowledge of basic chemistry, explain how these processes can destroy or prevent the growth of harmful or destructive microbes; eliminate or control chemical toxins; maintain nutrition quality; maintain desirable odors and textures; and increase the shelf life of specific foods. Have a student write the following three categories on the chalkboard: Perishable Foods, Semi-Perishable Foods, and Shelf-Stable Foods. Have students examine classroom references to identify several fresh or unprocessed foods which can be identified to list under each category. Have the students refer to the list of processes in the previous activity and identify one or more processes which would be appropriate to apply to the individual foods they listed under each category heading. Have them explain why the process is appropriate for the particular food.

[B] = Basic Skill Reinforcement

TAC 75.83
ADVANCED FOOD SCIENCE AND NUTRITION
UNIT III

COMPETENCY: (j.3) *Concepts and skills related to food science and food products.*

SUB-COMPETENCIES:

(A) *Evaluate the quality of food products for compliance with established standards.*

(B) *Determine the effect of various forms of ingredients on food products.*

(C) *Determine the effect of various manipulative procedures on the quality of selected food products.*

(D) *Determine the effect of various cooking utensils on food products.*

(E) *Determine the effect of various temperatures on food products.*

(F) *Evaluate the effect of various leavening agents on food products.*

(G) *Analyze principles of protein, vitamin, and carbohydrate cookery.*

(H) *Analyze factors which affect fat absorption when frying foods.*

(I) *Determine methods for making food products more nutritious.*

CONCEPTS	LEARNING AND EVALUATION EXPERIENCES
III. Food science and products A. Quality of food products 1. Food standards of content and quality	NOTE: Students who have not taken or successfully completed the Comprehensive Home Economics course or the Food Science and Nutrition course should have basic principles of food preparation instruction prior to beginning food preparation laboratory activities. Special emphases should be on safety and sanitation. A review of basic principles of food preparation may be desirable for those students who have successfully completed the Comprehensive Home Economics course or the Food Science and Nutrition course. Provide students with references, such as textbooks or government publications, which outline and describe legislation related to specific items for standards of quality, fill, and contents. Lead a class discussion on standards of quality, fill, and contents.

KEY QUESTIONS: Why do certain products have guidelines and others do not? What items are included?

Display examples of several items in class which have standards of contents established by the Food and Drug Administration. For each of the items, purchase different brands, such as store brand, national brand, and generic. Compare the quality and contents of the items.

2. Laboratory evaluation methods for food products

Lead a class discussion on the various organizations which set standards for food products, their functions, and methods of evaluating food products. Examples are the Food and Drug Administration, United States Department of Agriculture, United States Public Health Service, National Marine and Fisheries Bureau of the United States Department of Commerce, The Federal Trade Commission, and the Consumer Products Safety Commission. KEY QUESTIONS: What standards are set? Are there food products omitted from standards? Why are standards necessary? Who funds the cost of setting standards?

If available, invite a resource person from one of the agencies who evaluate food products to speak to the class and describe their role and function in evaluating food products. Have students prepare questions in advance to ask the resource person.

Define *physical properties*. Have students study references to identify physical properties of food such as sensory impression (color, flavor, smell, texture), boiling and freezing points, solubility, fluidity, plasticity, and melting point. Have students share the readings in class. Lead a class discussion on the readings. KEY QUESTION: What implications do these have for food preparation?[B]

Define *chemical properties*. Have students study references to identify chemical properties of foods. Give examples of some of the main chemical changes that take place when food is prepared either at home or commercially. Include hydrolysis of sugars and starches; fermentation of carbohydrates; cooking of starches; effects of browning; rancidity, hydrogenation, and reversion of fats; coagulation; effects of acids and bases; effects of salt; and effects of oxidation. Have students share the readings in class. Lead a class discussion on the readings. KEY QUESTION: What implications do these have for food preparation?[B]

After studying resource materials, have students describe to the class a chemical reaction in food and its results. Examples include fruit juices which may combine with oxygen from air and oxidize,

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[B] = Basic Skill Reinforcement

resulting in the loss of vitamin C; protein which will coagulate in meat or eggs as they cook; and fats which will solidify as they are hydrogenated.[B]

Divide the class into groups and have each group select one or more experiments in Teaching Aid 29, Chemical and Physical Properties. Upon the conclusion of the activity, have groups report findings back to the class.

B. Effect of ingredients on food products
  1. Ingredient substitutions
    a. Dehydrated ingredients
    b. Canned or frozen ingredients
    c. Fresh ingredients

As a group, have students list food sources which can be purchased by consumers in dehydrated form. For each item listed, lead a class discussion on positive and negative aspects. Examples of dehydrated food products available include nonfat dry milk, soup mixes, spices, and instant coffee. KEY QUESTIONS: Why are foods dehydrated? What are the advantages and disadvantages of dehydrating?

Display examples of canned and frozen foods to the class so that they can compare quality and cost of each. Compare such items as canned and frozen juices or canned and frozen vegetables. List the pros and cons of purchasing these items and discuss how they can be effectively used alone or in preparing other food items such as casseroles or baked products.Determine the unit price and/or price per serving for each food.[B]

As an enrichment experience or Student Occupational Activity, have students visit a grocery store or produce market to determine the quality and cost of fresh items. Record the cost, availability, and appearance of the items. Lead a class discussion on information gathered.

Using information from the previous activities or information provided, lead a class discussion to compare fresh to canned, frozen, and/or dehydrated foods. KEY QUESTIONS: Why would a consumer choose one particular type of food? Are there quality differences? Could cost savings outweigh the slight difference in quality for some food items?

As an enrichment experience or Student Occupational Activity, have students play the game, "What If." Given a recipe, the first person reads the ingredients substituting or leaving one out. The rest of the class points out the effects of this substitution or omission. If necessary, study references to determine the principles of food cookery that apply. The next person may use the same recipe and substitute or leave out a different ingredient. Determine the principles of cookery involved, and continue to the next person.

[B] = Basic Skill Reinforcement

2. Food product evaluation
    a. Color
    b. Flavor
    c. Texture

As a laboratory activity, have students create different casseroles using fresh, frozen, and dehydrated ingredients. A good casserole might be broccoli/rice. An ingredient available in different forms is soup (canned, fresh, and dehydrated). Choose a panel of taste testers to rate the quality of the casseroles. Focus the evaluation on color, flavor, and texture. Use Teaching Aid 28, Food Product Evaluation. Have students tabulate the results and lead a class discussion regarding the laboratory activity.[C]

As a laboratory activity, have students prepare a similar food item to the one above and have other class members attempt to determine if the ingredients were fresh, frozen, or dehydrated.

Have students use reference materials to identify common foods which change in color when exposed to air, acid, or alkali. Using resources on principles of food science, create experiments which students can conduct in the food preparation laboratory to discover how color changes occur in various foods. Experiments might include the following:

1) Effect of air exposure on color of cut surface of some fruits/vegetables—Have students use banana, apple, and avocado slices. All slices of a given food should be the same size and thickness. Leave a slice or two of each food exposed to air. Submerge a sample slice of each in individual water solutions containing either lemon juice, cream of tartar, or sugar; dip other slices in either dry sugar or salt; blanch additional slices for 30 seconds in boiling water. After exposure to solutions or treatments, allow slices to stand, exposed to the air, for 30-45 minutes. Have students compare results and suggest appropriate treatments of these fruits or vegetables when they are used in particular recipes. Discuss process which caused brown color on cut surfaces.[B]
2) Effects of acid-containing ingredients on dairy products—Have students prepare cream of tomato soup or another recipe containing an acidic ingredient which must be combined carefully with a milk base. Have some students add the acid-containing ingredient too quickly so that the milk products curdles. Lead a class discussion on reasons why milk curdles when exposed to acid.[B]
3) Effect of exposure to acidic/alkaline medium on color of vegetables—Select vegetables containing the following pigments: anthocyanin (red cabbage);

[C] = Common Essential Element

[B] = Basic Skill Reinforcement

anthoxanthin (onions, potatoes, cauliflower); and chlorophyll (broccoli, green beans, green cabbage). Using one-third of each vegetable, have students cook in plain water, water containing one-half teaspoon baking soda (an alkali), and water containing one-half teaspoon of an acid (such as vinegar or lemon juice). Boil in water or water solutions to cover until tender. Have students examine the color change of each type of vegetable which was cooked in each cooking medium. Explain the differences between pigments which are water soluble and those which are sensitive to pH variations.[B]

C. Effect of manipulative procedures on food products
  1. Mixing and kneading
  2. Cutting
  3. Canning
  4. Freezing
  5. Dehydration
  6. Irradiation

As a laboratory activity, have students prepare a baked product such as muffins, biscuits, or other quick breads to determine the differences in hand mixing versus mechanical mixing. Preparation of several items will provide for better comparison. Have specified groups use hand mixing and others mechanical mixing. Display the products and compare for quality and texture. KEY QUESTIONS: Is mechanical mixing always superior to hand mixing? What food items work best with a particular manipulation procedure?

Identify common foods which change in texture or consistency when they are over-agitated or manipulated during preparation, or exposed to excessive temperatures. Using resources on principles of food science, create experiments which students can conduct in the food preparation laboratory to discover how texture and consistency changes occur in various foods. An experiment might include the following:

- * Effect of too much agitation or manipulation on texture of baked products—Have students in small groups prepare small batches as in the case of biscuits, muffins, or other quick breads, or have some groups prepare and knead yeast bread for less time than is required. Have them compare their baked products for appearance and consistency or texture. Discuss the effect of manipulation on gluten, glutenen, and gliadin in flour. Additional experiments could be conducted comparing recipes with higher or lower amounts of sugar, oil, or eggs, all of which can affect appearance and texture of baked products.[B] [C]

Display various products which have been cut: diced, chopped, or sliced. Lead a class discussion and point out that some products may be cut into various sizes. KEY QUESTIONS: How does the

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[B] = Basic Skill Reinforcement

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size of the products affect color? How does the size of the products affect retention of nutrients? Why do different manufacturers market food products but in different product styles and product cuts?

Have students conduct a research project on various types of frozen and canned products. Allow students to report the findings to the class. Focus on the reasons for different manipulative strategies taken by the manufacturers.

Lead a class discussion regarding food products found in retail stores that have been cooked, frozen, dehydrated, or irradiated. If possible, display samples of food products. Identify foods that have been successfully preserved using freezing, canning, dehydration, and irradiation. KEY QUESTION: What are the advantages and disadvantages of using each procedure to preserve the food product?

As a follow-up activity, have students compare and taste test fresh cooked potatoes to those which have been dehydrated, canned, frozen, or irradiated. KEY QUESTIONS: How does the taste compare with the taste of a fresh cooked potato? What strategies have been used to retain nutrients? Is a canned, frozen, dehydrated, or irradiated food product less in nutritive value than a prepared fresh product? Why? Why not? Why has it become necessary to can, freeze, dehydrate, or irradiate food products?

Have students study resource materials on commercial canning, freezing, dehydration, and irradiation of foods. Have students report their findings to the class. KEY QUESTIONS: What foods are appropriate for canning, freezing, dehydration, or irradiation? What strategies have been used to retain nutrients? Is a canned, frozen, dehydrated, or irradiated food product less nutritious than a prepared fresh product? Why? Why not? Why has it become necessary to can, freeze, dehydrate, or irradiate foods?

Have students read reference materials to determine the role of irradiation on preserving foods and food products. Identify application of the irradiation process and the reasons for using it. KEY QUESTIONS: Has the Food and Drug Administration or another federal agency established minimum or maximum standards for irradiation? How does irradiation extend the lifetime of a food product? Does the manufacturer have to inform the consumer if the product has been irradiated?

Lead a class discussion defining *irradiation*, its purposes, and government regulations. Have students identify food products found in local grocery stores which have been irradiated. Have students compare their list of irradiated products.

CONCEPTS	LEARNING AND EVALUATION EXPERIENCES
D. Effect of cooking utensils on food products 1. Characteristics of cooking utensils a. Composition b. Size and shape	As a laboratory activity have students prepare selected packaged convenience foods using a variety of cooking utensils which vary in composition (clear glass, opaque glass, shiny aluminum, or darkened aluminum), size, and shape. Have the students compare the products and determine if baking utensils of different composition require adjustments in baking times or temperatures. Lead a class discussion regarding the reasons why the products varied in doneness and browning. Have students conduct a laboratory activity on the reaction of foods and cooking utensils. For example, chemicals in some foods will turn the cooking utensil a different color, such as a food product with high acid content will turn an aluminum utensil dark. KEY QUESTIONS: How does cooking food in an iron pan affect food composition? How do aluminum pans sometimes affect foods cooked in them? What is the composition of most commonly used cooking utensil? Have the students examine cooking pots and pans of a wide range of sizes and styles. Have groups list the advantages and disadvantages of cooking utensils which are made of particular materials, referring to resource materials which discuss the qualities of cooking utensils and consumer magazines which provide product evaluations. Survey the class to determine which material for pots and pans students think is the most desirable. Determine the sizes and shapes of pots and pans which the students think would be necessary as basic equipment in a kitchen for one or two people. If catalogs are available, have the students compute the probable cost of purchasing these basic items, constructed of the material the class voted as most desirable.[B]
2. Food product evaluation a. Color b. Flavor c. Texture	Using an evaluation chart such as the one in Teaching Aid 28, Food Product Evaluation, have the students evaluate the color, flavor, and texture of the products prepared in the previous laboratory activities. KEY QUESTIONS: How does composition, size, and shape of cooking utensils affect the quality of baked products? If a person wanted to bake rolls, which type of cooking utensil would provide baked products of the highest quality?
E. Effect of temperature on food products 1. Methods of heating food products a. Steaming b. Stir frying	In two laboratory activities, compare the preparation of vegetables using methods of steaming, stir frying, pressure cooking, boiling, microwave cooking, broiling, and grilling. Vegetables which would be good choices might include broccoli, potatoes, or squash. KEY QUESTIONS: How does the choice of cooking method affect foods? Can it be concluded that some foods are

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[B] = Basic Skill Reinforcement

c. Pressure cooking
d. Boiling
e. Microwave cooking
f. Broiling
g. Grilling

better prepared by one method than another? For example, which vegetables would best be prepared in a microwave oven? by stir frying?[C]

Identify common foods which change in flavor, texture, or appearance when overcooked. Using resources on principles of food science, create experiments which students can conduct in the food preparation laboratory to discover how flavor, texture, or appearance changes occur in various foods. Experiments might include the following:

1) Effect of cooking time on strong-flavored/mild-flavored vegetables—Have students cook one to two-cup portions of cauliflower, onions, celery, and spinach in water with salt added. One portion of each vegetable should be simmered for seven and one half minutes; the other portion should be heated for 15 minutes. Have students compare the intensity of the flavor, texture, and appearance of the vegetables cooked for shorter and longer time periods. Discuss how length of cooking time and cooking in a covered container/pan may affect the intensity of the flavor of vegetables from the Brassica or Allium families.
2) Effect of high heat on foods containing high levels of protein—Have students choose foods other than meats which contain high levels of protein (such as milk, cheese, and eggs). Have them search cookbooks or resources to find simple recipes for preparing these foods which involve heating in a saucepan or pan frying. In order to examine the effects of high heat on the foods, have the students prepare one-half of each recipe using high, fast heating (stirring to prevent burning), and the other half using recommended heating methods. Compare the texture, appearance, and palatability of the foods. After making the comparisons, have students identify reasons why one might choose to cook a food high in protein at a lower temperature for a longer period of time rather than cooking it faster at a higher heat.

2. Effect of freezing and refrigeration

Have students read resources on freezing and refrigerating foods and food products. Have students prepare a variety of food products to be stored for several days. Store some of the foods in the refrigerator and others in the freezer. KEY QUESTIONS: How should baked products be stored if they are to be kept for several days? for several months? Does freezing and/or refreezing affect the texture of food products? If so, how? At what temperatures should foods be kept frozen or refrigerated to

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[C] = Common Essential Element

maintain good quality? What are appropriate ways to prepare foods for freezing or refrigeration? [B]

Have students participate in experiments to determine the effects of freezing on foods. Laboratory experiments might include the following:

1) Effect of freezing on milk products, vegetables, and fruits—Have students freeze whole milk and reconstructed nonfat dry milk and, after a few days, thaw. Without agitating products to re-combine the separated solids and liquids, compare the appearance of the whole milk and nonfat milk. Have students thoroughly shake each product and compare the two liquids for palatability and consistency.
2) Have students choose various cooked vegetables, including potatoes, carrots, celery, and broccoli. Have them freeze small amounts of each vegetable for several days, then thaw and examine the changes in appearance and texture. Have them evaluate the thawed products for palatability and acceptability of appearance.
3) Have students choose various fresh fruits and prepare them for freezing in two ways, such as by blanching or by placing them in a sugar solution. Have them freeze small amounts of each fruit for several days. Then, ask students to thaw and examine the fruit to identify the changes in appearance and texture. Have the students evaluate the thawed products for palatability and acceptability of appearance.
4) Upon completion of the experiments on freezing, lead a class discussion on the implications of the findings for decisions about whether to use freezing as a preservation or storage method for selected food products. Also, discuss how freezing or refreezing foods can affect texture, color, and flavor.

3. Effect of altitude

Using library resources, have students determine the effect of altitude changes on temperatures for cooking foods, length of cooking time, and ingredient proportions. Lead a class discussion regarding the findings. KEY QUESTIONS: What effect does altitude have on cooking foods? Why? What other aspects of food preparation are affected by altitude? (Examples include length of cooking time; ingredient proportions; and temperatures.)

4. Food product evaluation

Have students compare the flavor, texture, and color of the vegetables and baked products prepared in the laboratory

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[B] = Basic Skill Reinforcement

CONCEPTS	LEARNING AND EVALUATION EXPERIENCES
a. Color b. Flavor c. Texture	experiences described previously in this unit. To evaluate products, have students use Teaching Aid 28, Food Product Evaluation.
F. Effect of leavening agents on food products 1. Forms of leavening agents a. Manipulation b. Steam c. Chemical agents d. Yeast	Hand out single copies of basic recipes for muffins, baking powder biscuits, waffles, popovers, fritters, dumplings, pizza dough made with yeast, sponge cake, sugar cookies, and corn bread to pairs of students. Be certain that everyone has at least one recipe to study. NOTE: Tell the students that you have an idea or concept in mind that you want them to guess, and this idea has to do with something that all of the recipes that have been handed out have in common. Give them one clue about the concept you have in mind–the thing which all of the recipes has in common does not have to do with the same specific ingredient present in each recipe such as salt, nor does it have to do with the fact that all of the items are subjected to heat to cook them. Tell them that they can talk together as a group about the common traits of the recipes and that one class member will act as recorder, writing the concepts/ideas they identify as common among the recipes on the chalkboard. Lead a class discussion regarding leavening agents. Identify different types of leavening agents and discuss their functions. Explain why some are more effective in producing a particular result than other possible leavening agents. Give occasional clues if the group has difficulty in finding the commonalty. After about ten minutes of discussion, ask each pair of students to identify the leavening agents which are used in their recipe.[C]
2. Food product evaluation a. Color b. Flavor c. Texture	Have one-half of the class prepare a pizza dough recipe which is leavened with baking powder and the other half of the class prepare a pizza dough recipe which is leavened with yeast. Have students bake small cheese pizzas for comparison purposes. Have the students develop rating scales to use to compare the pizza crusts in color, flavor, and texture. Similar laboratory comparisons could be conducted using recipes for breads such as yeast and quick breads, or cakes such as angel food cakes compared with butter cakes.[B] [C]
G. Principles of protein, vitamin, and carbohydrate cookery 1. Factors affecting protein cookery a. Eggs	Have students participate in an experiment to determine the effects of excessive temperatures on the flavor, texture, and appearance of eggs. The experiment might include the following: 1) Effect of heat on color of egg yolk—Have students hard cook eggs in the shell; boil others for 20 minutes. Fry scrambled eggs at a low temperature; fry at a higher temperature than recommended for eggs. Examine products for green color of yolks.

[C] = Common Essential Element

[B] = Basic Skill Reinforcement

Lead a class discussion regarding physical/chemical reaction which caused the color change. Also evaluate the food products for changes in texture and flavor.[B] [C]

Have students participate in experiments to study the factors affecting the coagulation temperature of egg proteins, including the effects of the addition of water, a weak acid, sugar, and salt to eggs prior to cooking. Discuss the implications of the findings from these experiments for the actual preparation of eggs for consumption. CRITICAL QUESTIONS: Does excessive heat destroy nutrients? Does excessive heat affect food product palatability? Does excessive heat affect food product texture?

Have students prepare food which requires the mixing of eggs with an acid. Demonstrate what occurs when the combination of eggs and acid is performed improperly. Explain how acid causes a chemical change in the proteins in the egg. Discuss how awareness of this effect can assist one in preparing more desirable food products containing eggs.[C]

b Meat, fish, and poultry

Have students participate in laboratory experiments to study the advantages of using cooking methods for meats, fish, and poultry which permit careful control of starting temperatures, cooking temperatures, and cooking times. Emphasize the differences in the amount of connective tissue and fat between various cuts of beef, pork, other red meats, fish, other seafoods, poultry, and giblets. Consider the influence of the amount of connective tissue and fat on the choice of appropriate cooking methods and temperatures.

Have students experiment to determine the preferred cooking methods and temperatures for preparing fabricated analogs which simulate meat, fish, poultry, fish, or seafood. Have the students compare the palatability of these analogs with the foods they simulate and with substitutes which contain a combination of the analogs and the real food. CRITICAL QUESTIONS: Does excessive heat affect food product palatability? Does excessive heat affect food product texture and tenderness?

Have students study references materials to determine the correct methods and appropriate temperatures for cooking meat, fish, and poultry. Have students experiment with various methods and temperatures. Experiments might include the following:

1) Effect of moist heat and dry heat cooking methods on various cuts of meat—Have students prepare tender and less tender cuts of beef using a variety of moist and dry heat cooking methods. Make comparisons

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[B] = Basic Skill Reinforcement

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based on tenderness, shrinkage, and palatability. Lead a class discussion regarding reasons why certain cuts of meat are less tender and may be less flavorful. Explain why moist heat methods are more appropriate for the less tender cuts of meat.[B] [C]

2) Effect of method of preparation such as temperature and dry or moist heat on flavor of ground beef patties—Have students prepare two-ounce lean ground beef patties by pan broiling, boiling in one inch of water, oven or grill broiling, and microwaving. Have students compare appearance and flavor of the patties. Lead a class discussion regarding the reasons why browning occurs when beef is heated using particular cooking methods and at sufficiently high temperatures. Have students describe why the meat which was pan or oven broiled has a more appealing flavor.[B] [C]

c. Legumes

Have students participate in laboratory experiments to study the factors affecting the rehydration of dried plant proteins or legumes, including the effects of soaking in plain water, water to which baking soda has been added, and water containing an acidic ingredient, such as chopped tomatos. Have students conclude which is the best medium for rehydration and determine the optimum soaking period for common dried legumes.

Have students prepare several foods containing rehydrated legumes and evaluate them for palatability. Have them compare these foods to others prepared following the same recipes, but using legumes which have not been dried and rehydrated, such as canned or frozen legumes. A blind taste test could be used to determine if it is possible to identify differences in quality between the two foods. CRITICAL QUESTION: Does the form of the legume affect the texture of the food product?

d. Cheese/milk

Have students participate in laboratory experiments which can be conducted in class that permit students to study the factors affecting the quality of cheese when it is heated without combining it with other mediums, when it is melted into a white sauce, and when it is baked as a part of a food combination, as in a casserole or baked cheesecake. Have students experiment to compare the palatability and appearance of foods prepared using the same recipes, but with unripened cheeses, ripened cheeses, or process cheese.

Have students participate in different laboratory experiments regarding what effects heat has on milk and cheese. CRITICAL

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[C] = Common Essential Element

CONCEPTS	LEARNING AND EVALUATION EXPERIENCES
	QUESTIONS: Does excessive heat destroy nutrients? Does excessive heat affect food product palatability? Does excessive heat affect food product texture?
2. Factors affecting vitamin and mineral cookery	Review nutrition information for the students, asking them to recall or reminding them of the vitamins and minerals which are water soluble and those which are fat soluble. Identify vitamins and minerals which can leech out of foods or cooking utensils when exposed to acidic foods or liquids. Assign each student a food which can lose nutritional quality if improperly stored or prepared and provide resources from which the student can learn about how the nutritive loss occurs. Have each student give a short oral report in class on the food item, the vitamins and/or minerals which can be lost through poor handling or preparation practices, and the recommended procedures to prevent or reduce nutritive loss in the food. Evaluate reports on the basis of content and communication skills.[B] Demonstrate the preparation of a meal containing a number of foods which can lose nutritive quality through improper handling. Show the students how nutritive losses commonly occur with various foods, such as boiling vegetables and discarding the cooking liquid, leaving fruits for fruit juices exposed to heat and light for extended periods, over-cooking meats, and peeling vegetables and discarding the edible peelings. Remind students of the nutritional content of the foods included in the demonstration. Lead a class discussion regarding procedures which can be followed when preparing foods so that the nutritional quality is not diminished.
3. Factors affecting carbohydrate cookery a. Grains and pasta	Have students participate in laboratory experiments which can be conducted in class that permit students to study the factors affecting the gelatination of cereals, such as wheat breakfast cereal, grits, and rolled oats. Similarly, have them conduct experiments which demonstrate the best methods for preparing grains which are subject to gelatination, including rice, barley, bulgur, and millet. As a practical application of their findings, have them experiment with cooking methods which enhance separation in cereal grains. CRITICAL QUESTIONS: Does excessive heat destroy nutrients? Does excessive heat affect food product palatability? Does excessive heat affect food product texture? What other ways might grain and pasta products be affected by too little or too much heat? Have students participate in laboratory experiments to study the factors affecting the consistency of food products which are thickened using starch granules. Have students conduct

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CONCEPTS	LEARNING AND EVALUATION EXPERIENCES
	experiments to compare the qualities of potato starch, cornstarch, tapioca, flour, and arrowroot as possible thickeners in various food products.[B] [C]
b. Bakery products	Have students participate in laboratory experiments to study the factors affecting the tenderness, leavening, browning, flavor, and appearance of baked products, including pastries, breads, cakes, and cookies. Evaluate the effects of baking the products in moderate or hot ovens and in microwave and convection ovens in comparison to a conventional oven. KEY QUESTIONS: How does excessive manipulation of quick bread doughs lead to less tender products? How does insufficient manipulation of yeast bread dough affect the finished product? What functions do leavening agents serve in bread products? How does the amount of liquid added to bakery products affect the finished product?
H. Factors affecting fat absorption in frying 1. Fats and oils in frying foods	Have students participate in laboratory experiments to study the factors affecting the quality of fried foods. Have the students experiment with fats and oils which have higher and lower smoke points, including lard, butter, corn oil, olive oil, hydrogenated fat, and margarine. Have students examine the differences between cooking time, browning, and palatability of various recipes for fried foods which contain different amounts of fat, protein, and sugar, such as doughnuts, deep fried fish, fried cheese, or breaded and fried vegetables. Have students participate in a laboratory experiment on retention of fats in foods while frying. Measure the amount of fat to be used in frying, fry the food, and measure the remaining fat after the product has been cooked. NOTE: Different groups of students could use different types of fat. Analyze why some foods absorb more fats than others. KEY QUESTIONS: Has there been water collected in the fat? Why or why not? How much has collected? How much fat is remaining? What happened to the missing fat? Does the type of fat used in frying affect the amount of fat absorbed by foods? Does frying temperature affect fat absorption by foods? How can fat absorption be reduced? Why is it desirable for fat absorption to be reduced?
I. Making food products more nutritious	Lead a class discussion regarding amino acids as component parts of protein. Show a table which indicates the protein foods which are complete in that they contain all of the essential amino acids and also indicates the limiting amino acids in plant proteins. Have students use the table to identify a supplementary plant or animal protein which, when combined with a plant protein containing a limiting amino acid, will form a meal containing all essential

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amino acids. Have students find recipes for foods high in plant proteins which make for an appealing meal and provide high quality protein through the combination of carefully selected foods.[B]

Lead a class discussion regarding ways to enrich the quality of some common foods by adding ingredients which will increase the content of complete proteins in the foods. Prompt students to think of the substitution in bread recipes of milk for water or other liquids, thereby increasing the protein quality of the recipe. Another improvement in protein quality in many recipes can be accomplished by adding an extra egg or other protein food; supplementing vegetable dishes with a small amount of meat, tofu, or nuts; and adding textured vegetable protein to the flour or grain called for in a recipe which is to be baked or spiced to mask possible flavor changes.

In an activity similar to the one above, have students suggest ways to add foods high in desirable vitamins or minerals to improve the nutritional quality of a recipe. For example, citrus fruit or juice can be added to a vegetable dish, enhancing not only appearance but the content of vitamin C in the meal. Grated carrots can be added to many recipes, from casseroles to cookies, increasing the amount of vitamin A. The addition of an extra egg in a recipe will not only improve the protein quality of the food, but also will increase the amount of iron and other minerals. Have a contest to create the most original and appealing food which has been supplemented with ingredients containing vitamins and/or minerals that would not ordinarily be included in the food. Have the recipe developers prepare them for tasting in class and take a vote to choose the contest winner.

Have the students conduct recipe development experiments to determine how much sugar, salt, or fat can be removed from recipes before the palatability or texture is affected significantly. Have students conduct recipe development experiments to increase the fiber content in recipes. KEY QUESTIONS: Why is it not possible for all sugar, fat, or salt to be removed from a recipe without negatively affecting the final product? What roles do these ingredients play? Do some recipes include more sugar, salt, or fat than is necessary for a successful product? What ingredients can be added to certain foods to increase the fiber content? Why is fiber important to the body? Why did the recipe initially not have the increased fiber content?

Have students study resources that indicate ways to make recipes and foods more nutritious. Have students select recipes and

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determine ways to alter or supplement them to make them more nutritious. Have students participate in laboratory experiments to prepare some of the recipes that have been changed to produce more nutritious food products. Students may conduct recipe development experiments to increase nutrient content of foods. Evaluate the food products and the nutritional increase. KEY QUESTIONS: Why is it easier to increase the nutrient content in some recipes but not others? What are the advantages of increasing the nutrient content in food products? Are there disadvantages of increasing the nutrient content in food products? What ingredients can easily be added to foods to increase nutrient content?[B]

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TAC 75.83
ADVANCED FOOD SCIENCE AND NUTRITION
UNIT IV

COMPETENCY: (j.4) *Concepts and skills related to food and nutrition technology.*

SUB-COMPETENCIES:

(A) *Evaluate new forms and sources of foods and food products.*

(B) *Summarize major research in nutrition and food science.*

(C) *Discuss the effect of technology on food and nutrition and food supply, marketing, and distribution.*

(D) *Propose ways to disseminate and use reliable nutrition information.*

CONCEPTS

IV. Food and nutrition technology
- A. New forms and sources of foods
  - 1. Advances in food technology
    - a. Preparation and consumption
    - b. New products for food service industry
    - c. Food engineering
    - d. Aquaculture
    - e. Agricultural advances in technology

LEARNING AND EVALUATION EXPERIENCES

Have students visit a supermarket to identify foods which are new on the market. Examples might include dehydrated foods, freeze dried foods, de-hydrofrozen foods (a process which combines freezing and dehydrating), IQF (individually quick freezing), microwave foods, irradiated foods, sterilized food in a retort pouch, and others. Have students compile a list of the new food products and the prices. Compare the price of the products to products which have been on the market. Calculate the cost differences and the cost per serving. For example, compare the price of regular popcorn to microwave popcorn. KEY QUESTIONS: Why are new food items continually being developed? Are these foods more or less expensive than regular items? Why?[B]

Purchase some of the new items found during the market comparison. As a laboratory experience, have students prepare the foods. Lead a class discussion on new food products. Evaluate the products for flavor, cost, appearance, texture, and time required in preparation. KEY QUESTIONS: Would people buy and eat the new food items? Why or why not? How are the new food items, studied in class, similar to other foods? different from other foods?[C]

Have students write a creative paper which describes foods which may be a part of the diet in the year 2020. KEY QUESTIONS: Will people be eating the same foods in the future? Why might it be necessary to eat different foods? What foods might be available in 2020?[B]

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Lead a class discussion regarding the advances made in food packaging as a part of food technology. Note the fact that packages should be convenient, informative, and protective. Display a variety of commercial food packaging materials and products packaged with them.

Have students visit a supermarket as an enrichment experience and note the packaging of at least six food items. List and describe the packaging. Examples might include packages that are perforated film bags which control respiration and moisture loss for fresh fruit and vegetables, plastic bags which are suitable for boiling or for using in the microwave, paperboard trays coated with heat resistant polyester that are used in the microwave, or others. KEY QUESTIONS: What is the specific purpose or function of the packaging? Is the packaging adequate for consumer use?

Ask a manager of a restaurant, large hotel restaurant, or other food service personnel to present information on new products which are available and used by their kitchens. KEY QUESTIONS: How has food technology affected the availability and choices of foods made by restaurants? How do food sources available today compare to those available ten years earlier? What new food items will be available in ten years?

Using nutrition and/or food research journals, have students research new food items being developed. Have each student choose a new food item and write a report. KEY QUESTIONS: Why was this food item developed? How was it prepared? What effect will this new food source have on individuals, families, and others?[B]

Have students view audiovisuals on the use of water and other resources as a means of producing new food products. Ask an agriculture teacher, agricultural extension agent, or other appropriate agricultural representative to present information on recent advances in agricultural technology, including aquaculture and biotechnology.

2. Food testing and evaluation

Have students write to major food companies and request information on their procedures of testing and evaluating foods. Lead a class discussion on procedures for testing and evaluating foods.[B]

As a laboratory experience, have students prepare a simple experimental food such as a bread with soy flour or a cake with added fiber. After preparing the product, lead a class discussion regarding methods of testing the food. Describe techniques and

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[B] = Basic Skill Reinforcement

CONCEPTS	LEARNING AND EVALUATION EXPERIENCES
	equipment that are used to evaluate food items. Factors to consider should include volume, density, color, texture, flavor, and acceptability. NOTE: A comparison of products could be conducted with this activity. Emphasis could be placed on healthy cooking practices which could promote good nutrition.
B. Research in nutrition and food science 1. Research methods a. Animal studies b. Human studies	Lead a class discussion or invite a resource person to class to speak on the importance of research in food science and nutrition. KEY QUESTIONS: Why is research needed? How may research be beneficial? Who conducts the research? Why are animals used in research? What steps have been taken to protect animals used in research?
	Using reference materials, locate an article which describes the use of animals in nutrition research. Present the information to the class. As a group, discuss the article to determine justification for the research, the method or procedure utilized, the results or findings of the study, and the implications.[B]
	Lead a class discussion regarding nutrition or food science research using humans as subjects. Compare this research to that which uses animals as the subjects. KEY QUESTIONS: What are the differences in animal and human research studies? Why are humans not used in all research studies?
	Have a nutritionist or food scientist present information on their research. KEY QUESTIONS: What experiments are presently being conducted? Does the experiment include animals or humans? What is the significance of the research? What are the practical implications of the study? What previous studies have been conducted?
2. Current issues in food science research	If laboratory facilities are available, conduct a simple animal nutrition experiment. For example, two rats can be fed. One rat can be fed a diet high in fat and the other rat can be fed a diet low in fat. Records of the food intake, weight gain, and appearance can be charted and compared for the animals. Results can be written in a short article.[B]
	Have students study references that provide information on current issues in food science and nutrition. Examples of issues include, but are not limited to, the following: 1) the relationship between cholesterol and exercise; 2) the relationship between cholesterol and smoking and/or alcohol consumption; 3) the relationship between nutrition and cancer; and

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4) the relationship between food additives and good health and well being.

Working in groups, have each group appoint a chair and recorder. Have the groups summarize their readings and share the information with the class.[B] [C]

C. Effect of technology on food and nutrition
  1. Technology and availability of foods

Have students study references that address the American food production and distribution system. Emphasis should be placed on the various stages and steps in food production and distribution. Some topics to include are the following: food, nutrition, and agricultural research; plant and animal research; agricultural production, processing plants, food product packaging and labeling; transportation, storage and distribution; marketing, advertising, retail food markets, and food service. KEY QUESTIONS: What is a food production system? What is a food distribution system? Why is the American food production and distribution system important? If the American food production and distribution system does not function efficiently, what short-term and long-term impacts does it have upon American citizens? other countries? How can food costs, food availability, food quality, and nutritional well-being of citizens be affected positively or negatively by the American food production and distribution system? What is the relationship of the American food production and distribution system to each of the following: 1) food, nutrition, and agricultural research, 2) plant and animal research, 3) agricultural production including farming, ranching, aquaculture, horticulture, and/or orchard production, 4) food processing plants, 5) food manufacturing plants, 6) packaging and labeling, 7) food transportation, 8) food storage, handling, and distribution, 9) food marketing and advertising, and 10) wholesale and retail food markets.

Lead a class discussion on the meaning of technological advances and have students cite new food products which appear to be the result of one or more technological advances including but not limited to artificial and synthetic foods. Pose the following questions to the class: Is a new food product always an advance, or could it be a setback? How does technology sometimes adversely affect aspects of the food system? Return to the list of new products and discuss whether these products will improve the quality and/or availability of foods. Cite an example of a food or beverage which failed in the marketplace because it was too costly, it failed to meet a consumer want or need, or it was not effectively marketed. Encourage students to discuss the reasons why technological advances might not improve the standard of living of consumers.

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CONCEPTS	LEARNING AND EVALUATION EXPERIENCES
2. Marketing and market research	Distribute copies of magazines and newspapers which include articles on marketing strategies or reports on market research surveys. Invite a resource speaker from the Small Business Administration to class to explain the value of market research in successful retailing. Lead a class discussion regarding the research tools that market researchers and advertisers employ to increase sales to target populations. Identify the ways in which technology can improve the effectiveness of marketing strategies, especially in the area of telecommunications and computerization.[C] Using resource materials, obtain figures on the advertising budgets of major food producers/manufacturers and, if possible, determine the percentage of the companies' total sales which is the cost of the advertising and marketing of products. Lead a class discussion regarding the question of whether sophisticated, high technology advertising campaigns are worth the increased cost of the food product to the consumer, who ultimately pays the price of the marketing when purchasing the product.
3. Transportation and distribution	Have students do library research to discover the countries of origin, other than the United States, of various foods which are imported into the American market, such as bananas, pineapples, coffee, and certain fish products. Compile a list of the ways in which technological improvements in worldwide agricultural production and transportation systems have increased the variety of foods available in retail food markets in the United States.[B] Invite a local grocery store owner, a food wholesaler, or a representative of a trucking company to class to speak about the distribution problems in the food industry. Ask the speaker to identify foods which are difficult to transport, store, and/or handle when loading and unloading. Have the students prepared to ask the resource person questions. KEY QUESTIONS: Why are particular foods not readily available in retail stores in certain seasons of the year? How does the cost of food distribution affect the overall cost of the foods in retail markets.[C]
D. Dissemination and using reliable nutritional information 1. Sources	NOTE: Those interested in nutrition often want to know sources of reliable nutrition information. Resources which are reliable and available to all consumers include the United States Department of Agriculture (USDA), the Texas Agricultural Extension Service (TAES), Food and Drug Administration (FDA), Texas Department of Health and Human Services, professional journals, and knowledgeable professors of nutrition or biochemistry, dietitians, and other qualified professionals. Journals which might be particularly appropriate for lay persons include Nutrition Today,

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CONCEPTS	LEARNING AND EVALUATION EXPERIENCES
	The Journal of the American Dietetic Association, and Nutrition Reviews. Obtain nutrition and food science information such as pamphlets, articles, or other materials from reliable sources and present to the class. Discuss with students valid and reliable sources of nutrition and food science information. Describe ways that lay persons can obtain this information. Have students distinguish reliable nutrition sources from non-reliable sources. KEY QUESTIONS: Do all reliable nutrition sources identify their sources of information? How can one determine the reliability of the information?
2. Media distribution	Lead a class discussion regarding nutrition and food science information presented by the media-television, radio, and newspaper. Identify information which is reliable and informative and that information which may not be reliable. KEY QUESTIONS: Who is presenting the information? What are his/her credentials? Are the claims reasonable? Is the information obtained from a professional journal? Have students locate an article in available resources which describes an interesting and current nutrition or food science topic, such as the relation of food to cancer. Have each student prepare a newspaper article or broadcast report which summarizes the information and then present the information to the class.[B]
3. Educational programs	Identify educational programs related to nutrition and food science. Lead a class discussion on the information available through the educational programs. Have students plan, organize, and present a lesson to a group of children and a lesson to a group of peers and adults. The lesson for children might emphasize food selection and good eating habits. The topic for peers and/or adults might include information on meeting special dietary needs, food preparation techniques, meal planning, food budgeting, reducing cholesterol and sodium in the diet, and food shopping. Evaluate the presentations on content and effective communication.[B] [C]

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TAC 75.83
ADVANCED FOOD SCIENCE AND NUTRITION
CAREER OPTIONS AND ADJUSTMENTS

COMPETENCY: (a.7) *Concepts and skills related to career options and adjustments.*

SUB-COMPETENCIES:

(A) *Relate personal characteristics to the appropriate career(s) addressed within each home economics course.*

(a.2 A) *Identify employment opportunities and preparation requirements in chosen field.*

(B) *Describe management practices facilitating individuals assuming multiple roles.*

(C) *Discuss demands and rewards in relation to personal and family life.*

(D) *Demonstrate effective money management.*

CONCEPTS

Career options and adjustments
- A. Personal characteristics needed for food science and nutrition careers
  - a.2 A. Employment opportunities and preparation requirements

LEARNING AND EVALUATION EXPERIENCES

NOTE: In situations when both Food Science and Nutrition and Advanced Food Science and Nutrition are offered on a campus and taken by the same students, it is recommended that the Career Options and Adjustments unit in the Food Science and Nutrition course focus on careers related to nutrition, food preparation, and dietetics. The Advanced Food Science and Nutrition course should focus on careers related to food science, processing, marketing, and technology.

Have students review selected references on employment opportunities, preparation requirements, personal characteristics, and qualifications needed in careers related to advanced food science and nutrition. Lead a class discussion about each employment opportunity identified and why each characteristic, education requirement, and other qualifications are necessary. A resource person could be invited to the class to address these items and the identified food science and nutrition careers. Have students prepared to ask the resource person questions. KEY QUESTIONS: How do the personal characteristics influence employees and affect the populations and clients they serve? How can individuals develop desirable job characteristics?[B] [C]

Invite the school counselor to class to discuss preparation requirements for careers in food science and nutrition. Have

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students prepared to ask questions regarding educational requirements, career preparation time, career preparation, and costs.[C]

Have students read resources on the employment outlook in food science and nutrition occupations for the next five to ten years. KEY QUESTIONS: How is the outlook related to either food science or nutrition? Where are the projected jobs?[B] [C]

Have each student choose a job in the food industry or a professional position in the career fields of food science or nutrition and conduct an analysis of what employers would look for when hiring a person to do this job. Using classroom resources, library references, assistance from vocational counselors, and information from interviews with local employers, each student should write a report about the responsibilities of a particular job, the necessary qualifications of an employee in the job, where employers advertise the job, and what a prospective employee would have to demonstrate to an employer in order to be hired.[B] [C]

As an enrichment activity, have students prepare a bulletin board which portrays the personal characteristics needed by employees who work in the food service industry or in food science and nutrition careers.[C]

Instruct students to develop a generic list of areas of knowledge, skills, and attitudes that a person who will be successful in a food science or nutrition career should possess. Using the list, have each student write an assessment of his or her suitability for a specific job category in this career field. As a group, discuss the qualities that make people right for jobs which involve producing, processing, distributing, marketing, retailing, preparing, or serving foods.[B] [C]

Obtain sample copies of job applications for various companies which are involved with the food system or nutrition field. Make transparencies of a few of the applications and have the class assist in completing sections of each, discussing the specific responses which would make an applicant more successful in getting the job.[C]

Encourage students to brainstorm to identify types of food service businesses an entrepreneur might consider. Examples: restaurant lunch truck, catering business, specialty food business, or delicatessen. List factors that should be considered before

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establishing a food service business. KEY QUESTIONS: Why should one consider characteristics of the community, such as the number of other food service establishments, the average income, the standard of living, and the cultural and religious aspects of the community? Discuss positive and/or negative influences that each factor can have. How could these factors influence one's decision about opening a food service business?[C]

Using resources, have students define the term *career ladder*. Lead a class discussion regarding the career ladder. It should be related to occupations identified in the advanced food science and nutrition course. Use Teaching Aid 30, Career Ladder, to illustrate career opportunities in the restaurant industry. KEY QUESTIONS: Why do career ladders exist? What are their purposes? How do they help a person who is considering a career or developing a career? Does experience or training allow one to enter the ladder in a higher position? Why?[C]

B. Management practices and multiple roles

Provide a list of management skills to students, such as allocating time so that necessary activities can be completed or handling money effectively. Have students indicate the extent to which they are not satisfied with their abilities to perform these skills well in their daily lives. Next have students identify a job in the food or nutrition industries which they might hold ten years from now. Ask them to repeat the analysis of the list of management skills, identifying those which might become more difficult for them as a result of holding the food/nutrition job and/or performing new multiple roles. After the review, encourage students to choose at least one management skill that they could work on improving prior to being challenged to do so by taking on new personal roles and work responsibilities. Talk with each student individually and discuss ways he or she could improve his or her management skills and prepare for the demands of the future.[C]

Lead a class discussion on management skills needed for multiple roles. NOTE: Some food and nutrition occupations require non-traditional work hours. Some occupations are more stressful than others. Have students identify hypothetical situations for various occupations and describe what management practices will be needed to accomplish multiple roles.[C]

C. Demands and rewards of careers in food science and nutrition

As a group activity, have the class name ten different food science and nutrition careers. List the names of these careers in a column on the left side of a chalkboard or poster. In a column to the immediate right of each career, have students identify one work role which would be extremely demanding for a person in the career. In a third column to the right, have the class identify a

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[C] = Common Essential Element

characteristic of the typical work schedule of a person in the career. Finally, create a fourth column in which the student will suggest one reward, either intrinsic or extrinsic, which makes the career worth pursuing. After completing all of the columns, have a class discussion about the ten careers. KEY QUESTIONS: What are negative aspects of the careers? Could a characteristic considered positive by one person be considered negative by another person? Why? What characteristics about each career would contribute to or deter from a happy and satisfying personal and family life? Why?[C]

Have students identify the reasons why a person might like a food science and nutrition career. Pose the question, "What would make one better prepared for promotions and advancement on the career ladder?" Follow with a discussion regarding how technology is changing occupations and the importance of a person continuing to stay up-to-date on industry advancements. CRITICAL QUESTIONS: What occupations within food science and nutrition could be affected by technology? Why? What could a person do to prepare for changes?[C]

D. Effective money management

Have students determine an average salary for entry level, mid-management and management positions in careers related to food science and nutrition. After determining the average salaries, have students work in groups to develop profiles of different sizes of families and develop a budget at each salary level for a family. KEY QUESTIONS: How adequate is income for the family described? Will it be adequate for a single-income family? Would it be adequate for a permanent situation or strictly transitional? What basic standard of living could a family expect?[B] [C]

Lead a class discussion about budgeting and other methods of reducing costs involved in employment. (Examples: use public transportation rather than owning a personal vehicle or paying for parking at work; working at a company that provides uniforms; working at a company that provides discounts; working at a location close to home; working for an employer that provides child care.) KEY QUESTIONS: How do these techniques relate to the quote, "A penny saved is a penny earned?" How could one's net earnings in effect be increased by good budgeting and money management practices?[C]

Invite a company personnel manager, utilize a company's employee orientation materials, or have students study selected references to determine types, definitions and characteristics of employee financial incentives. Include bonuses, stock options,

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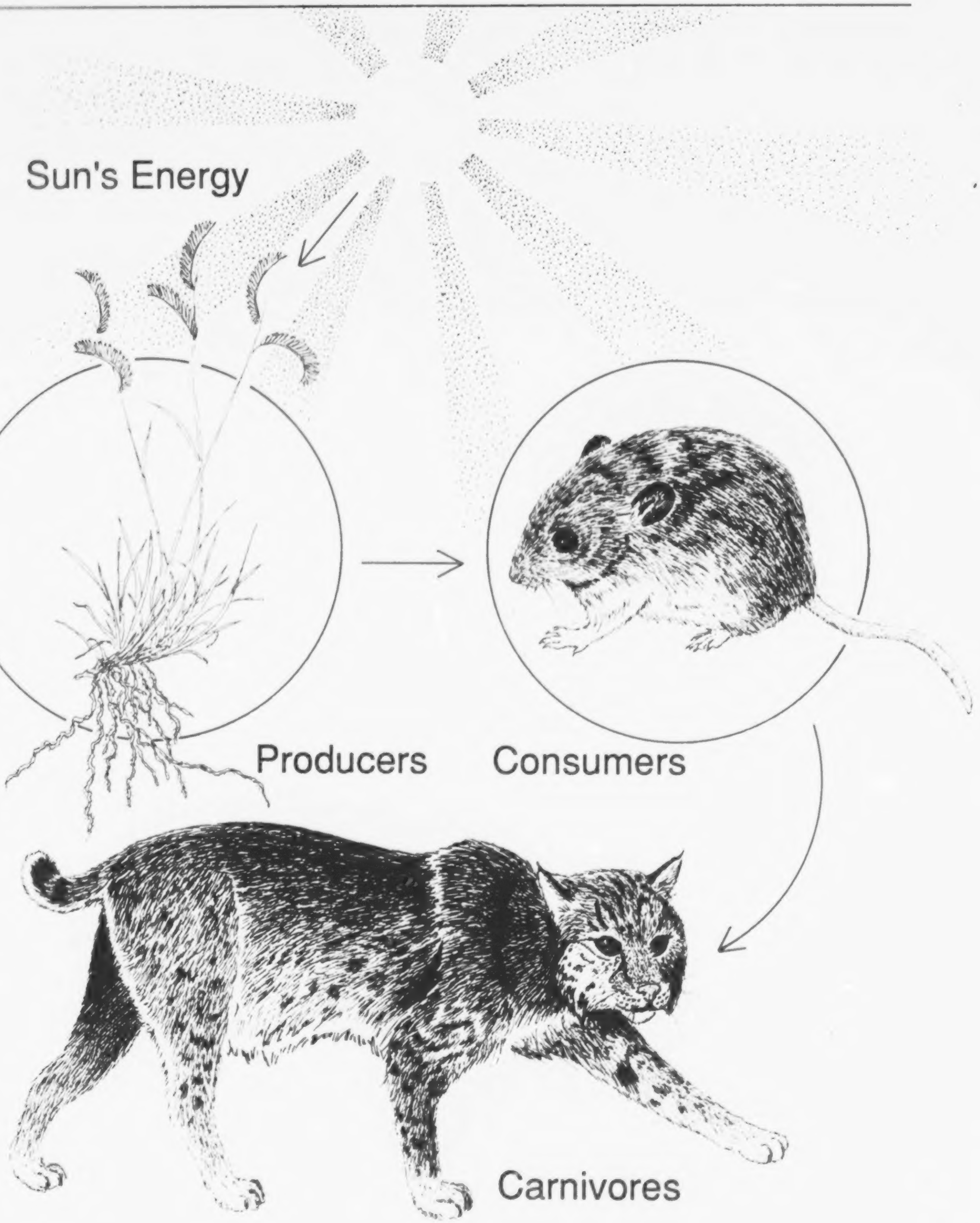
[C] = Common Essential Element
[B] = Basic Skill Reinforcement

savings and profit sharing, promotions, retirement/pension plans, and credit unions. Divide class into groups to play "Password," giving one-word clues describing the specific financial incentives. Reward points based upon the number of clues necessary to determine the incentive being described. KEY QUESTIONS: How would each of the incentives affect a family's income? a family's budget? How can each inventive help provide for retirement years? children's education? leisure activities? housing? Which incentives could be provided by small companies? by large companies?[B] [C]

[B] = Basic Skill Reinforcement
[C] = Common Essential Element

TEACHING AID SECTION

FOOD CHAIN


Sun's Energy
Producers
Consumers
Carnivores

FOOD CONSUMPTION PATTERNS

DEVELOPED COUNTRIES

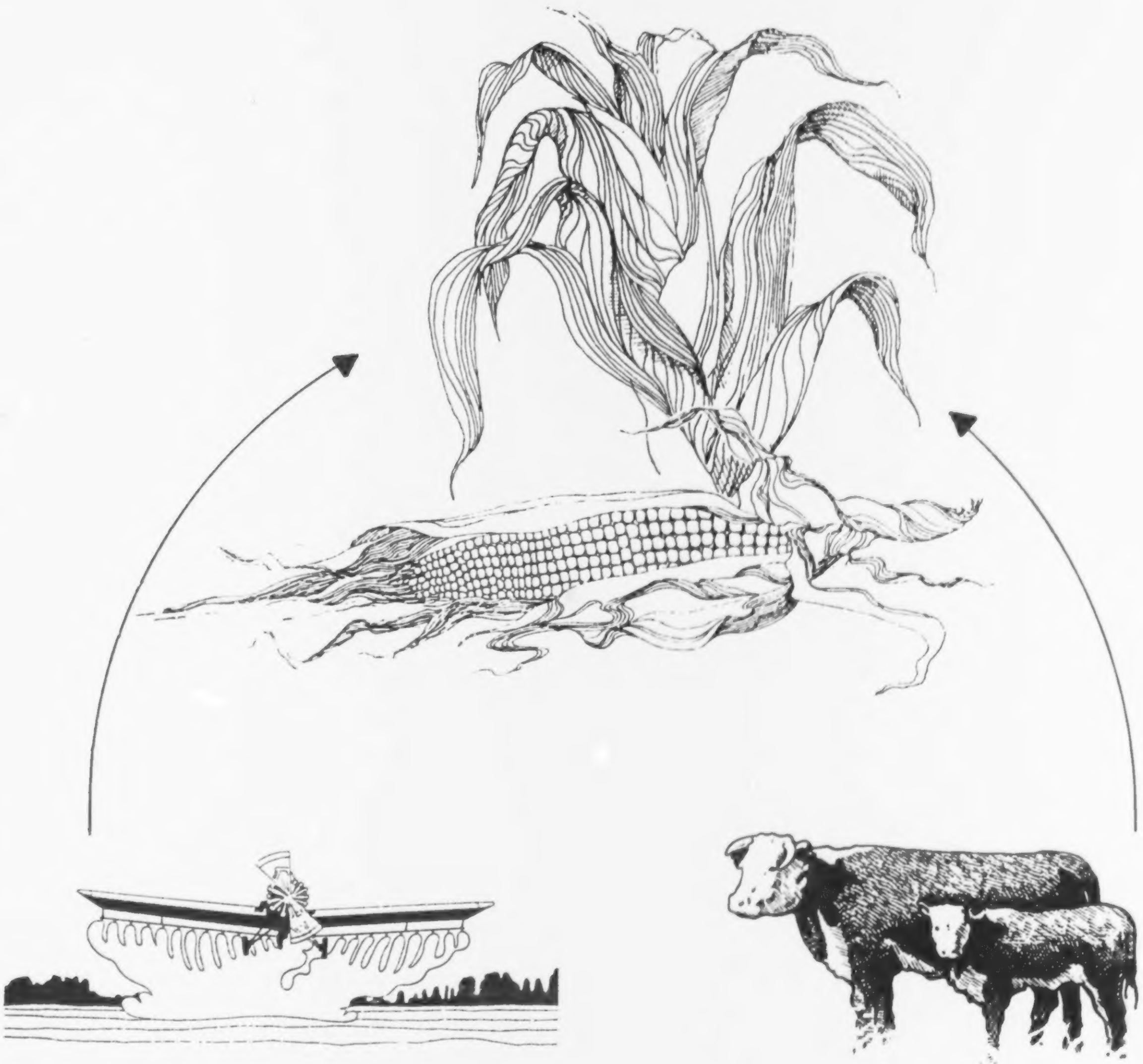
Countries	Calories Per Day	Grains & Starches	Fruits & Vegetables	Meat Poultry Fish	Fat & Oils
North America	3155	40%	9%	34%	17%
Western Europe	3111	46%	8%	28%	18%
USSR	3182	70%	4%	17%	9%
Total	3043	55%	7%	24%	14%

LESS DEVELOPED COUNTRIES

Countries	Calories Per Day	Grains & Starches	Fruits & Vegetables	Meat Poultry Fish	Fat & Oils
South America	2276	68%	7%	17%	8%
China	2045	80%	9%	8%	3%
Southeast Asia	2121	82%	8%	7%	3%
Africa-South of Sahara	1730	80%	10%	5%	5%
Total	2097	77%	10%	8%	5%

Sources: FAO Food Balances

"ORGANICALLY" AND "INORGANICALLY" GROWN


Chemical Fertilizers and Pesticides
Organic Fertilizers

SODIUM CONTENT OF SELECTED FOODS

Food	Sodium Content (mg)
Apple Pie	406
Brownie With Nuts	126
Catsup	177
Cheddar Cheese	119
Chicken Noodle Soup	955
Corn	236
Devil's Food Cake With Chocolate Icing	118
Egg	61
Frankfurter	627
Fudge (Chocolate)	86
Ice Cream	75
Margarine	138
Milk (Whole)	138
1 Olive (Green)	168
Peanut Butter	177
Pickle	1922

Assume all foods consist of one standard serving

Sugar Content of Breakfast Cereals

Product	Manufacturer	Total Sugar (% dry weight)
Sugar Smacks	Kellogg	56.0
Apple Jacks	Kellogg	54.6
Super Sugar Crisp	General Foods	46.0
Frosted Rice Krinkles	General Foods	44.0
Cap'n Crunch's Crunch Berries	Quaker Oats	43.3
Cocoa Pebbles	General Foods	42.6
Cookie Crisp, Chocolate	Ralston-Purina	41.0
Sugar Frosted Flakes	Kellogg	41.0
Cookie Crisp, Oatmeal	Ralston-Purina	40.1
Alpha-Bits	General Foods	38.0
Trix	General Mills	35.9
Cocoa Puffs	General Mills	33.3
Post Raisin Bran	General Foods	30.4
Raisin Bran	Kellogg	29.0
Frosted Mini-Wheats	Kellogg	26.0
100% Bran	Nabisco	21.0
All-Bran	Kellogg	19.0
40% Bran Flakes	General Foods	13.0
Total	General Mills	8.3
Wheaties	General Mills	8.2
Grape Nuts	General Foods	7.0
Special K	Kellogg	5.4
Corn Flakes	Kellogg	5.3
Rice Chex	Ralston-Purina	4.4
Corn Chex	Ralston-Purina	4.0
Wheat Chex	Ralston-Purina	3.5
Cheerios	General Mills	3.0
Shredded Wheat	Nabisco	0.6
Puffed Rice	Quaker Oats	0.1

Condensed and adapted from an analysis published in 1979 by the U.S. Department of Agriculture.

TA 6

Create A Low-Sugar Menu

Directions: Rewrite the following menu to lower the sugar content.

Morning Meal	**Revised Morning Meal**
2 glazed doughnuts filled with jam Kool-Aid	
Noon Meal	**Revised Noon Meal**
candy bar carbonated beverage	
Evening Meal	**Revised Evening Meal**
glazed ham candied sweet potatoes canned corn fruit cocktail root beer	
Snacks During The Day	**Revised Snacks**
gumdrops cake with frosting sugar cookies sugar-syrup coated popcorn	

Create A Low-Sodium Menu

Directions: Rewrite the following menu to lower the sodium content.

Morning Meal	**Revised Morning Meal**
2 fried eggs 2 slices of bacon 2 pieces of white toast orange juice	
Noon Meal	**Revised Noon Meal**
chicken noodle soup 1 large pickle saltine crackers apple carbonated beverage	
Evening Meal	**Revised Evening Meal**
meat loaf spinach deviled eggs white roll and butter bread pudding buttermilk	
Snacks During The Day	**Revised Snacks**
banana crackers and cheese spread apple pie	

TA 8

PUT FIBER IN YOUR MENU

DIRECTIONS: Fiber can be easily added to daily menus. Rewrite the following menus to include sources of fiber at each meal. Circle the fiber sources added to the menus.

Morning Meal orange juice breakfast taco (tortilla with scrambled eggs, sausage, cheese, and hot sauce)	**Revised Morning Meal**
Noon Meal carbonated beverage 3 slices of pizza (pepperoni with mushrooms and extra cheese) candy bar	**Revised Noon Meal**
Evening Meal milk fried chicken mashed potatoes with gravy green beans white roll and butter brownie	**Revised Evening Meal**
Snacks Throughout Day dry roasted peanuts cheese and crackers ice cream	**Revised Snacks**

Create A Low-Fat Menu

Directions: Rewrite the following menu to lower the fat content.

Morning Meal 1 bagel with cream cheese 2 slices of bacon chocolate milk	**Revised Morning Meal**
Noon Meal 3 slices of pizza (sausage, olives, extra cheese) 1 slice of cheesecake milk shake	**Revised Noon Meal**
Evening Meal steak fried potatoes salad with dressing white roll and butter ice cream sundae with whipped cream whole milk	**Revised Evening Meal**
Snacks During The Day dry roasted peanuts cheese and crackers banana nut bread potato chips	**Revised Snacks**

TA 10

Basic 1500 Calorie Menu

Directions: Adjust the following menu to show serving sizes and/or menu subtitutions for a pregnant adult woman. Then, adapt the menu for a teenaged pregnant woman and a lactating mother.

Morning Meal	**Revised Morning Meal**
1 scrambled egg 1 slice buttered wheat toast 1 cup coffee	
Noon Meal	**Revised Noon Meal**
1 ounce boneless baked fish 1/2 cup macaroni 1/2 cup broccoli 1 cup milk 1 cup green beans	
Evening Meal	**Revised Evening Meal**
2 ounces lean broiled sirloin steak 1 cup black-eyed peas 1/2 cup carrots 1 slice white bread 1 cup unsweetened tea 1 medium orange	
Snacks During The Day	**Revised Snacks**
1 ounce cheddar cheese 4 saltine crackers 1 cup vanilla ice cream	

Food Additive Terminology

Term	Definition
Food Additives	become part of a food product when added either intentionally or incidentally. Examples of incidental or unintentional additions include small amounts of pesticides, drugs fed to animals, and chemical substances that come from plastic packaging materials. Intentional purposes for using food additives include adding nutrients, using preservatives to maintain freshness, combining emulsifiers, stabilizers, thickeners, texturizers, leavening agents, pH control agents, humectants, maturing and bleaching agents, and/or anticaking agents to help in processing food products, and making food more appealing with flavor enhancers, flavors, colors, and sweeteners.
Nutrients	enrich or fortify a food product to maintain or improve nutritional value. Nutrients may enrich a product to replace vitamins and minerals lost in processing of the product or fortify it by adding nutrients that may be lacking in a person's diet.
Preservatives	prevent food from spoilage, from bacteria, molds, fungi, and yeast. These additives also extend the shelf life and protect the natural color or flavor of a product.
Antioxidants	delay or prevent a food product from turning rancid or browning.
Emulsifiers	help to evenly distribute tiny particles of one liquid into another, and improve the consistency, stability, and texture of food products.
Stabilizers, Thickeners, Texturizers	impart body, improve consistency or texture, stabilize emulsions, and affect how the food feels in an individual's mouth.
Leavening Agents	affect cooking results, texture and volume of food products.
pH Control Agents	change or maintain the acidity or alkalinity in food and drink products.
Humectants	cause a food product to retain moisture.
Maturing and Bleaching Agents Dough Conditioners	accelerate the aging process of the food product as well as improve its baking qualities.
Anticaking Agents	prevent lumping or caking of a finely powdered substance.
Flavor Enhancers	supplement, heighten, or alter the original taste and/or aroma of food without imparting its own flavor.
Flavors	heighten natural flavor and/or restore flavors lost in proccessing.
Colors	give an appetizing or characteristic color to foods.
Sweeteners	make the aroma or taste of food more agreeable or pleasurable.

TA 12

Food Additives and Their Purpose

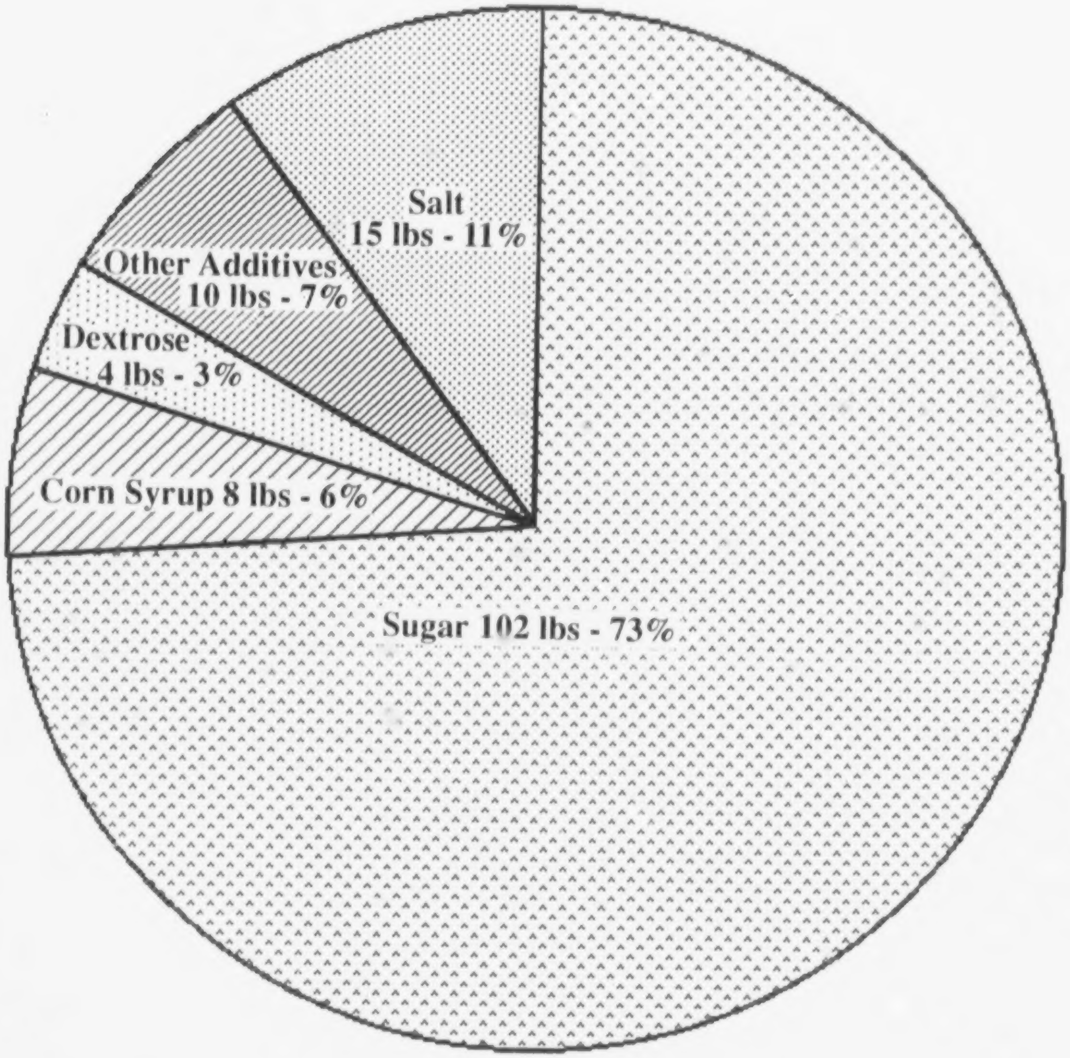
Ascorbic acid—nutrient, preservative, and antioxidant
Benzoic acid—preservative
Benzoyl peroxide—maturing and bleaching agents, and dough conditioners
BHT (butylated hydroxytoluene)—antioxidant
Calcium phosphate—leavening agent
Calcium silicate—anti-caking
Caramel—color
Cellulose—stabilizer, thickener, and texturizer
Citric acid—preservative, antioxidant, and pH control
Citrus Red No. 2—color
Corn syrup—sweetener
Dextrose—sweetener
Diglycerides—emulsifier
Disodium guanylate—flavor enhancer
Food, Drug, and Cosmetic Act Colors:
    Blue No. 1—color
    Red No. 3—color
    Yellow No. 5—color
Gelatin—stabilizer, thickener, and texturizer
Glucose—sweetener
Glycerine—humectant
Guar gum—stabilizer, thickener, and texturizer
Iodine—nutrient
Iron oxide—color
Lactic acid—pH control, and preservative
Lecithin—emulsifier
MSG (monosodium glutamate)—flavor enhancer
Paprika—flavor, and color
Pectin—stabilizer, thickener, and texturizer
Phosphates—pH control
Polysorbates—emulsifiers
Potassium bromate—maturing and bleaching agents, and dough conditioners
Propylene glycol—stabilizer, thickener, texturizer, andhumectant
Riboflavin—nutrient , and color
Saccharin—sweetener
Saffron—color
Silicon dioxide—anti-caking
Sodium acetate—pH control
Sodium bicarbonate—leavening
Sodium nitrate—preservative
Sodium nitrite—preservative
Sorbic acid—preservative
Spices—flavor
Tartaric acid—pH control
Vitamin A—nutrient

TA 13

EXAMPLES OF FOOD AND NUTRITION LEGISLATION

1850	California passed a pure food and drink law.
1897	Tea Importation Act was passed, providing for inspection of all tea entering U.S. ports.
1906	Original Food and Drug Act of 1906 passed, prohibiting interstate commerce in misbranded and adulterated foods, drinks, and drugs.
1906	Meat Inspection Act was passed, addressing unsanitary conditions in meat packing plants.
1913	Gould Amendment was enacted, requiring that definite quantity information appear on food packages.
1930	McNary-Mapes Amendment was enacted, authorizing standards of quality and fill of container for canned food.
1938	The Federal Food, Drug, and Cosmetic (FDC) Act of 1938 was enacted containing food-related provisions which: * Authorized standards of identity, quality, and fill of container for foods * Authorized factory inspections
1939	First Food Standards were issued for canned tomatoes, tomato purée, and tomato paste.
1950	Oleomargarine Act was passed, requiring prominent labeling of colored oleomargarine to differentiate it from butter.
1958	Food Additives Amendment was enacted, prohibiting use of new food additives until safety is established and FDA issues use regulations.
1960	Color Additive Amendments were enacted, allowing FDA to set regulations for safe use of color additives in foods, drugs, and cosmetics.

Percentages of Annual Additive Intakes



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ALLOCATION OF MAJOR SOURCES OF FOOD ENERGY IN THE DIET

Diet A: 50% Animal Sources/50% Plant Sources

1,250 calories from animal sources
X 10= (enter product here) ________calories (in plant energy units)

1,250 calories from plant sources
X 10= (enter product here) ________calories

TOTAL (enter sum of two products here) ________calories

X 5 billion = ________
(calories necessary to feed world's population on Diet A)

Diet B: 25% Animal Sources/75% Plant Sources

625 calories from animal sources
X 10= (enter product here) ________calories (in plant energy units)

1875 calories from plant sources
X 10= (enter product here) ________calories

TOTAL (enter sum of two products here) ________calories

X 5 billion = ________
(calories necessary to feed world's population on Diet B)

Diet C: 10% Animal Sources/90% Plant Sources

250 calories from animal sources
X 10= (enter product here) ________calories (in plant energy units)

2,250 calories from plant sources
X 10= (enter product here) ________calories

TOTAL (enter sum of two products here) ________calories

X 5 billion = ________
(calories necessary to feed world's population on Diet C)

My Diet Directions: Using a table of food composition, determine the total number of calories you have consumed from animal and plant sources over the previous 24 hours and fill in the calculations in the spaces provided below.

Animal Sources of Calories (include milk, cheese, ice cream, eggs, butter, etc.)

Source, Serving Size, and Number of Servings Calories

____ = __________

____ = __________

____ = __________

____ = __________

____ = __________

Total calories consumed from animal sources = __________

Plant (Vegetable) Sources of Calories

Source, Serving Size, and Number of Servings Calories

____ = __________

____ = __________

____ = __________

____ = __________

____ = __________

Total Calories Consumed from plant sources = __________

Total Food Energy Required if Everyone in the World Followed My Diet:

_______ Calories from animal sources

X 10 = (enter product here) _________calories (in plant energy units)

_______ Calories from plant sources

X 1 = (enter product here) _________calories

TOTAL
(enter sum of two products here) _________calories

X 5 billion = _________
(calories necessary to feed world's population on my diet)

SHARING THE WORLD'S FOOD ENERGY

PRIOR TO THE ACTIVITY: Prepare a large bowl of peanuts (60 to 100). Also have available for reference a table showing population totals by country throughout the world. Have the class assist in calculating the number of students in the class which would represent 6% of the total group. Calculate the size of the remaining group and determine how many would be necessary to form a group of 2/3 of the total. Finally, calculate the number of peanuts from the bowl which would represent 30% of the total.

ACTIVITY (20 to 30 minutes)

1. Identify the appropriate number of students which represents 6% of the class and declare them United States citizens. Ask another student in the class to volunteer to represent all of America's animals (agricultural) and have that student join the group of Americans.

2. Randomly assign 2/3 of the remaining students to another group representing underdeveloped or "Third World" countries in the world. These students may determine which countries they are from and how many actual persons they represent, based on their country's population from the reference table.

3. Assign the remaining 1/3 of the group to represent developed countries other than the United States. These students may determine which countries they are from and how many actual persons they represent.

4. Distribute 30% of the peanuts to the group of students representing the United States (not including the student who represents the animals). Tell the class that this food represents the total number of plant origin calories which America requires to feed either animals or people. Tell them they must wait to eat their peanuts.

5. Distribute 50% of the rest of the peanuts to the group of students who represent developed countries other than the United States. These students may distribute the peanuts as they wish among the various countries they represent. There is no requirement that they divide the food evenly or representatively according to the population sizes of the various countries. Negotiation among the students in the group will determine the proportion of the food distribution. Have them wait to eat.

6. Distribute all of the remaining peanuts to the students representing underdeveloped countries. Again, these students may distribute the peanuts as they wish among the various countries they represent. Have them wait to eat also.

7. Tell the United States group that they can select two people from either of the other two groups from which they will pretend to buy some food. The people they select must sell their food in whatever quantity and at the price determined by the United States group. The food which is purchased must be turned over and will be given to the "animal". The persons who sell their food can buy more food from anyone in any of the other groups, but they must buy it at the price determined by the seller.

8. When everyone has his or her portion, all of the students may eat their food. No one may negotiate outside or his or her group for more food.

9. Discuss the events which took place in this activity.

PREAMBLE TO THE CONSTITUTION OF THE FOOD AND AGRICULTURE ORGANIZATION

(Ratified by 42 countries in 1945)

The nations accepting this Constitution being determined to promote the common welfare by furthering separate and collective action on their part for the purposes of:

Raising levels of nutrition and standards of living of the people under their respective jurisdictions,

Securing improvements in the efficiency of production and distribution of all food and agriculture products,

Bettering the conditions of rural populations,

And thus contributing toward an expanding world economy,

Hereby established the Food and Agriculture Organization of the United Nations.

PROGRAM GOALS OF THE WORLD HEALTH ORGANIZATION (WHO)

1. Development and testing of methodologies for integrating nutritional objectives into national development plans

2. Development and testing of methodologies for establishing nutrition monitoring and surveillance systems as a basis for action programs and for their evaluation

3. Integration of nutrition activities primarily within maternal and child care, as a component of primary health care

4. Promotion of and collaboration in measures for the control of endemic goiter

5. Further development, and the testing under varying conditions, of methods for control of Vitamin A deficiency and nutritional anemia

6. Promotion and support of further studies needed for a better understanding of factors responsible for malnutrition and related problems

7. Collaboration in training health workers in nutrition

LIVING THE LIFE OF THE ONE BILLION POOREST IN OUR WORLD

Think of your home as it is today. Imagine the furniture, the appliances, the entertainment equipment. Think about the food in the cupboards and the refrigerator. If there is a family pet in your home, think about how it is treated and what it is fed. Create a picture in your mind of what you will eat for dinner tonight and the snacks you might have later in the evening.

Now imagine that you and your family are to be transferred into an equally typical family of the underdeveloped world. First, most of the furniture will be removed from your house. After the beds, chairs, tables, light fixtures, and all of the electrical appliances (including televisions, stereo, radio, and telephone) are gone, your family will be left with a few old blankets, a kitchen table, and one wooden chair. All of the clothing in the house will go—each member of the family may keep his or her oldest pair of clothes. The head of the family will have a well-worn pair of shoes, but none for the rest of the family.

Let's move into the kitchen. There is no refrigerator and the cupboards are bare. One box of matches, a pound of flour, and small amounts of sugar and salt are left. There will be no food for the family pet—it will have to fend for itself. A few moldy potatoes will provide much of tonight's meal. Along with a few onions for flavor and some beans, this will provide the only food for the entire family tonight and tomorrow.

The house has been stripped: no bathroom, no running water, no electricity. In fact, your house will be taken away. The entire family can move to a toolshed. It is crowded, but not unlike the way families live in many parts of the world. A United Nations report describes the living conditions of families in one poor country this way: "It is not uncommon for a family of four or more to live in a bedspace, that is, on a bunk bed and the space it occupies—sometimes in two or three tiers—their only privacy provided by curtains."

Even with all of this, your family is still not living at the level of life in the greatest part of the world. All of the other houses in your area also have been removed; the whole area has become a shanty town. There is no communication from the outside world There is only one radio in the entire town. No more newspapers, magazines, or books available, but it doesn't matter. No one in your family can read them anyway.

Government services are nonexistent. There are no mailcarriers, no firefighters. Only one, two-classroom school serves the entire neighborhood, but it doesn't matter, since only a tenth of the children in the neighborhood go to school. The nearest medical clinic is ten miles away and is tended by a paramedic. People who need medical care must either walk to the clinic or take the bus which comes by every other day or so. They might be lucky and find a seat inside the bus, instead of having to climb on top for a ride.

Finally, your family will be allowed to keep a cash hoard of five dollars. Meanwhile, the adults and older children in the family must earn their keep. As a peasant farmer, the head of the household may have two to three acres to tend, raising the equivalent of $200 to $500 worth of crops a year. There will be enough for the family to eat. Or almost enough. The adults in the family will average a daily caloric intake of 1700 to 1900 calories. Because of the hard work and malnourishment of an unbalanced diet, in addition to the hazards of disease, your life expectancy will drop to around 40 years of age.

These are the subsistence living conditions of over one billion people in the world today. Of course, this offers only an impression of what life is like for these people. Still lacking are the things that underdevelopment gives as well as those it takes away: the smell of poverty, the sight of diseased, suffering people and animals, the flies, the open sewers. When we are told that half the world's population represent the poorest in their own "undeveloped" countries, this is what the figures mean.

Adapted from Heilbroner, Robert L. *The Great Ascent.* Harper and Row, 1963.

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Fabricated Food Products

Product	Function	Use	Advantages & Disadvantages
surimi/kamoboko	fish protein	used to attain cost-effective filleting, mincing, and water-washing	lower cost under development to combine with red meat products
sucrose polyester	fat substitute	used to replace fat in all types of food used as an additive in lipstick to prevent sweating	cuts down on cholesterol contains no calories interferes with absorption of fat-soluble vitamins tends to act as a laxative when consumed in large quantities
aspartame	artificial sweetener	used to replace sugar in almost any product	contains no calories taste is almost identical to sugar
milk protein hydrolysate	replaces egg albumen in recipes	used as a whipping agent in marshmallows, candy bar centers, mousse, sorbets, frozen novelties, low-fat and reduced-calorie desserts, frostings, and whipped beverages	cost savings of 20-40%
synthetic analog of fructose	artificial sweetener	dietary aid that can help fat lose weight and thin gain weight	still under development
"fluffy cellulose" (cellulosic materials bathed in dilute hydrogen peroxide)	flour substitute	used in baked goods	high fiber content, reduces calories in baked goods 20-30%

TA 21

Ways To Market a Product

☞ Through the choice of name for the product

☞ By developing a product which is very convenient or has high utility

☞ By packaging which is appealing in form and color

☞ Through labeling which is informative and readable

☞ By pricing the product so that it competes successfully with other brands

☞ By conducting marketing surveys and planning a strategy for introducing the product to the market

☞ Through an effective advertising campaign

THE HACCP SYSTEM OF CLASSIFICATION

The hazard analysis critical control point procedure consists of three hazard categories.

CATEGORY 1: **Hazards Caused by the Ingredients in the Unprocessed Product**

The food product contains an ingredient or ingredients which could introduce potentially pathogenic organisms or toxins in food, or which may have a flavor, color, or nutrient which can change during processing.

CATEGORY 2: **Hazards Related to the Manufacturing Process**

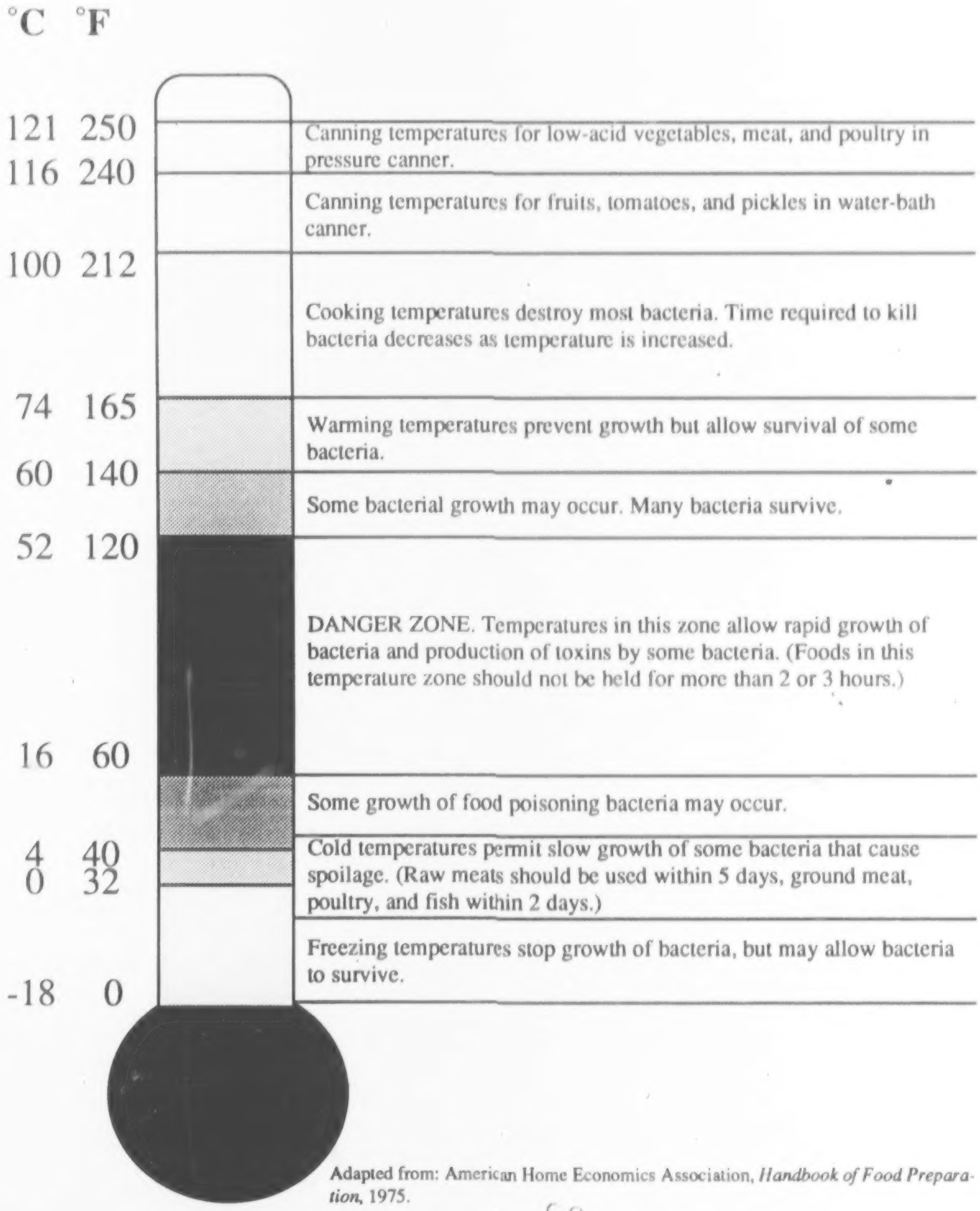
The manufacturing process may not effectively destroy harmful bacteria, it may decrease the strength of any protective elements in the food which prevent contamination, or it interferes with the maintenance of quality in the food.

CATEGORY 3: **Hazards Caused by Inadequate Planning for Storage and Distribution**

During the distribution process, the storage period, or in the handling by consumers in retail outlets, the quality or safety of the product could be reduced due to lack of adequate packaging or sufficient levels of chemical preservatives in the product.

TA 23

Temperature of Food for Control of Bacteria



Canning temperatures for low-acid vegetables, meat, and poultry in pressure canner.

Canning temperatures for fruits, tomatoes, and pickles in water-bath canner.

Cooking temperatures destroy most bacteria. Time required to kill bacteria decreases as temperature is increased.

Warming temperatures prevent growth but allow survival of some bacteria.

Some bacterial growth may occur. Many bacteria survive.

DANGER ZONE. Temperatures in this zone allow rapid growth of bacteria and production of toxins by some bacteria. (Foods in this temperature zone should not be held for more than 2 or 3 hours.)

Some growth of food poisoning bacteria may occur.

Cold temperatures permit slow growth of some bacteria that cause spoilage. (Raw meats should be used within 5 days, ground meat, poultry, and fish within 2 days.)

Freezing temperatures stop growth of bacteria, but may allow bacteria to survive.

Adapted from: American Home Economics Association, *Handbook of Food Preparation*, 1975.

Preservation of Foods

Canning

Home

Advantages:

- inexpensive
- avoids wasting an abundance of seasonal fruits or vegetables
- can be done in glass jars or tin cans

Disadvantages:

- foods lose nutrients
- light can destroy nutrients of foods in glass jars
- vegetables and meats can contain botulism if not processed at the proper temperature
- some foods need to be treated to prevent darkening

Commercial

Advantages:

- can be done quicker than home canning to prevent nutrient loss

Disadvantages:

- foods in cans cannot be viewed by the consumer before purchase

Freezing

Home

Advantages:

- better control of the temperature
- preserves the flavor, appearance, and nutritive value of fresh foods

Disadvantages:

- large ice crystals can damage food cells and alter the texture

Commercial

Advantages:

- quickfreezing is used so that food cells are not damaged and texture is not altered
- preserves the flavor, appearance, and nutritive value of fresh foods

Disadvantages:

- incorrct handling of products while in transit can cause inadequate temperature control, spoilage, and nutrient loss

Drying

Home and Commercial

Advantages:

- stops the growth of microorganisms
- very simple method
- foods are lightweight
- foods take up less space

Disadvantages:

- sun drying depends on the weather and takes several days
- foods need to be treated to prevent browning, loss of vitamins C and A, and loss of flavor

Processing Methods – Rating Scale

PRODUCTS COMPARED	TASTE			APPEARANCE		
	Excellent	Fair	Poor	Excellent	Fair	Poor
Product A ______ Canned						
Product A ______ Frozen						
Product A ______ Dried						
Product A ______ Irradiated						
Product B ______ Canned						
Product B ______ Frozen						
Product B ______ Dried						
Product B ______ Irradiated						
Product C ______ Canned						
Product C ______ Frozen						
Product C ______ Dried						
Product C ______ Irradiated						

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Processes for Preserving Foods

Sterilization
Pasteurization
Blanching
Concentration
Drying
Baking
Extrusion
Radiation
Filtration
Extraction
Holding at a high temperature
Vacuum packing
Freezing
Use of humectants
Fermenting
Chemical alteration of pH
Addition of antibiotic agent
Use of chemical metabolic inhibitors
Smoking

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Food Packaging

Moisture-Proof Paper	raw meats fish
Airtight Bags or Wrapping	bread cakes frozen desserts ice cream
Plastic Bags	dried fruit ripe fruit fresh vegetables
Airtight Containers	grain products cereals cakes
Covered Containers	cooked fish ripe fruit fresh vegetables dried vegetables canned fruit cheese

FOOD PRODUCT EVALUATION

DIRECTIONS: Rate each food on a scale of 1 to 4 (1=poor quality and 4=excellent quality) for color, flavor, and texture.

ITEM	COLOR	FLAVOR	TEXTURE

Chemical and Physical Properties

Directions: Conduct one or more of the following experiments to demonstrate the effects of preparation and storage on the chemical and physical properties of foods.

◆ Cut an apple in fourths.
Let one piece set out all period or overnight.
Wrap another in foil and a third in plastic wrap.
Treat the fourth with lemon juice or other citrus juice to show how acid can decrease tannin oxidation and improve aesthetic qualities of apples in salads.

◆ Cook one portion of frozen broccoli, Brussels sprouts, or cauliflower according to package directions with a lid and another portion without a lid.
Taste test both.
The one cooked without a lid may taste milder in flavor since sulfur in the vegetables was permitted to escape during cooking.

◆ Cook one package of broccoli with lemon juice added.
Cook another package in water.
Compare the color.
Note the drab color when broccoli is cooked in an acid medium.
Cook fresh, sliced beets using the same methods.
Compare the color.

◆ Cook one pan of carrots in an acid medium.
Cook another pan of carrots in an alkaline medium.
Note that the color pigment is not changed significantly in either medium.

◆ Demonstrate the texture and flavor differences of a vegetable cooked the same length of time in a pan with a lid and another without a lid.
Note that cooking with a lid shortens cooking time by creating a small amount of pressure and retains more nutrients.
The one cooked without a lid may taste raw or uncooked.

◆ Taste test a box of cereal which is several weeks old.
Compare the flavor and texture of old cereal to that of the same type of new cereal.
Point out reasons for off flavors due to rancidity development.
Note change in texture due to deterioration of additives such as BHT or BHA.

◆ Store part of a cream pie, chicken salad, tuna sandwich, or other food containing protein on an agar plate in the refrigerator.
Let another part set out several days on an agar plate.
Test both for contamination.
Note that protein foods are a good medium for bacterial growth.
Proper storage is essential to prevent spoilage.
Do not select custard or cream pies from an unrefrigerated case.

◆ Broil a less tender cut of meat.
Use a moist heat method to cook an identical cut of meat and note tenderness.

◆ Simmer one egg at 185° F. and boil one at 212° F. to show effects of heat on protein foods.
The boiled egg may be tough and have rubbery white and yolk.
The sulfur in the white combines with iron in the yolk producing a greenish coating on the yolk.
The simmered egg should be tender and not discolored.

CAREER LADDER

LEVELS	
Top-level	MANAGER OR OWNER
Management	CHEF Needs extensive training and experience
Supervisory	COOK Needs training and experience
Mid-level	ASSISTANT COOK Needs training or experience
Entry-level	KITCHEN HELPER Needs no training or experience